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Volume 51 June 1961 Number 2

AN APPROACH TO THE RELIGIOUS GEOGRAPHY OF THE UNITED STATES: PATTERNS OF CHURCH MEMBERSHIP IN 1952[1]

WILBUR ZELINSKY
Southern Illinois University

ALMOST all human geographers will accept the truism that among the phenomena forming or reflecting the areal differences in cultures with which they are so intimately concerned, few are as potent and sensitive as religion. In seeking to grasp the identity, conformation, and implications of such cultural regions as may exist in the United States, we must inevitably approach the areal patterns of religious characteristics and their interactions with other human activities and cultural traits. The immediate inspiration for this study is a simple curiosity concerning the nature of these patterns, for it is abundantly clear from the available evidence that this nation has a startling profusion of denominations, considerable variation in their relative strength from place to place, and altogether more than enough complexity through time and space in the relationships between religion and other factors to challenge the ingenuity of the geographer. A larger purpose is implicit, however. It is hoped that this paper may provide not only a first approximation of the nation's religious regions and an introductory statement of the shape and meaning of areal variations in American religious characteristics, but that it may also contribute some material toward our still quite shadowy delineation of the general cultural regions of Anglo-America and stimulate some thought as to the variety of ways in which religious data might be used in other kinds of geographic work.

In spite of the clear logic of granting religion a prominent place on the geographer's agenda, a review of the literature indicates surprisingly little discussion of the subject, whether for the United States or for other parts of the world. A perusal of five of the larger and more important general treatises on human geography discloses the fact that two do not directly confront the topic of religion at all,[2] two others limit their treatment to a single paragraph,[3] and only one deals with religion in more than cursory fashion.[4] Similarly, two major surveys of significant recent research[5] contain no references to work on

[1] This study was supported by a research grant from Southern Illinois University. I also wish to express my gratitude to John E. Brush, Rutgers University, J. Fraser Hart, Indiana University, and Philip W. Porter, University of Minnesota for the opportunity to examine notes, maps, and seminar papers relevant to the geography of religion in the United States that were produced under their supervision.

[2] P. Vidal de la Blache, *Principes de Géographie Humaine* (Paris, 1941) and Maximilien Sorre, *Les Fondements de la Géographie Humaine*, 3 vols. (Paris, 1947–52).

[3] Alfred Hettner, *Allgemeine Geographie des Menschen, I. Band. Die Menschheit, Grundlegung des Geographie des Menschen* (Stuttgart, 1947), pp. 146–147 and V. C. Finch, G. T. Trewartha, A. H. Robinson, and E. H. Hammond, *Elements of Geography, Physical and Cultural*, 4th ed. (New York, 1957), p. 534.

[4] Roberto Almagià, *Fondamenti di Geografia Generale*, 2 vols. (Roma, 1945–46), II, pp. 578–581. Figure 24, pp. 588–589 is one of the better world maps of religious adherence.

[5] Griffith Taylor, ed., *Geography in the Twentieth Century*, 3rd ed. (New York, 1957), and Preston E. James and Clarence F. Jones, eds., *American Geography: Inventory and Prospect* (Syracuse, 1954). In a briefer survey, Jan O. M. Broek, "Progress in Human Geography," pp. 34–53 in Preston E. James, ed., *New Viewpoints in Geography; Twenty-Ninth Yearbook National Council for the Social Studies, 1959* (Washington, 1959), does enter a plea for the study of religion as a major element in cultural geography; but there is no reference to any published studies.

the geography of religion. There can be little doubt that a wider search of the literature would yield equally disappointing results. Only one book-length attempt to deal with the geography of religion has been published, one that is, by the author's admission, an experimental effort based on inadequate materials.[6] Four shorter—and, again, rather provisional—treatments of the subject merit attention, even though they are intentionally limited in purpose and accomplishment.[7] There are innumerable instances in the geographic literature of passing references to the religious situation in discussions of the human geography of various regions, but only a few serious efforts to delve deeply into the relationships between religious and other geographic phenomena.[8] In the case of the United States, only a single pair of highly tentative discussions, both sociological, can be recommended to the student interested in the contemporary geography of religion on a national scale;[9] the available geographical literature on the more limited aspects of the American religious scene consists of two doctoral dissertations, one on religious institutions in Cincinnati and the other treating the historical geography of Roman Catholicism in the Atlantic Seaboard states.[10]

All this would be a matter of interest largely for the specialist in geographic bibliography or the history of ideas were it not that the factors that have generally inhibited work on the geography of religion also operate to circumscribe sharply the possible compass of this paper. There is, first of all, the simple inadequacy of the available statistics and other

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[6] Pierre Deffontaines, *Géographie et Religions* (Paris, 1948). This erudite volume, which leans heavily on anthropological literature, deals almost exclusively with the impact of religion on settlement features and various aspects of human behavior as a one-way process; it is limited in scope, so that it never sorts out the various religions or discusses their geography *per se* nor attempts to explore the multi-directional interplay among religion, non-religious phases of culture, history, and the physical environment.

[7] Paul Fickeler, "Grundfragen der Religionsgeographie," *Erdkunde*, Vol. 1(1947), pp. 121–144 (presents a valuable critical bibliography of German-language materials relevant to the geography of religion as well as a discussion of some of the methodological problems of the field); H. J. Fleure, "The Geographical Distribution of the Major Religions," *Bulletin, Société Royale de Géographie d'Egypte*, Vol. 24(1951), pp. 1–18; Eric Fischer, "Some Comments on a Geography of Religion," an unpublished paper read at the 1956 meeting of the Association of American Geographers and abstracted in *Annals*, Association of American Geographers, Vol. 46(1956), pp. 246–247; and, by the same author, "Religions, their Distribution and Role in Political Geography," pp. 405–439 in Hans W. Weigert, *et al., Principles of Political Geography* (New York, 1957). The last item does exceed the limits implied in its title and, in addition to providing a valuable survey of the distribution of the major faiths, indicates some interesting points of departure for future research on the non-political, as well as political, aspects of the geography of religion.

[8] The outstanding examples are: E. Friedrich, "Religionsgeographie Chiles," *Petermanns Mitteilungen*, Vol. 63(1917), pp. 183–186; Ludwig Mecking, "Kult und Landschaft in Japan," *Geographischer Anzeiger*, Vol. 30(1929), pp. 1–10; Herman Lautensach, "Religion und Landschaft in Korea," *Nippon. Zeitschrift für Japanologie*, Vol. 8(1942), pp. 204–219; Wilhelm Credner, "Kultbauten in dem Hinterindischen Landschaft," *Erdkunde*, Vol. 1(1947), pp. 48–61; John E. Brush, "The Distribution of Religious Communities in India," *Annals*, Association of American Geographers, Vol. 39(1949), pp. 81–98; Etienne de Vaumas, "La Répartition Confessionnelle au Liban et l'Equilibre de l'État Libanais," *Revue de Géographie Alpine*, Vol. 30(1955), pp. 511–604; Helmut Hahn, "Konfession und Sozialstruktur; Vergleichende Analysen auf Geographischer Grundlage," *Erdkunde*, Vol. 12(1958), pp. 241–253 (dealing with the Hunsrück district in Western Germany); Angelica Sievers, "Christentum und Landschaft in Sudwest-Ceylon," *Erdkunde*, Vol. 12(1958), pp. 107–120; and Andrew H. Clark, "Old World Origins and Religious Adherence in Nova Scotia," *Geographical Review*, Vol. 50(1960), pp. 317–344. Perhaps the most ambitious of the regional treatments of the geography of religion is Xavier de Planhol, *The World of Islam* (*Le Monde Islamique; Essai de Géographie Religieuse*) (Ithaca, N. Y., 1959); but it must be considered a brilliant sketch rather than the definitive statement on a huge and complex subject.

[9] T. Lynn Smith, "Religious Composition," pp. 175–189 in *Population Analysis* (New York, 1948) and Donald J. Bogue, "Religious Affiliation," pp. 678–709 in *The Population of the United States* (Glencoe, Ill., 1959). Two items by an American geographer which have religious overtones are also basically sociological in approach: Walter M. Kollmorgen, *Culture of a Contemporary Rural Community; the Old Order Amish of Lancaster County, Pennsylvania*, USDA, Bureau of Agricultural Economics, Rural Life Studies No. 4 (Washington, 1942), and "The Agricultural Stability of the Old Order Amish and Old Order Mennonites of Lancaster County, Pennsylvania," *American Journal of Sociology*, Vol. 49(1943), pp. 233–241.

[10] Wesley Akin Hotchkiss, *Areal Patterns of Religious Institutions in Cincinnati*, University of Chicago, Department of Geography, Research Paper, No. 13 (Chicago, 1950), and Sister Mary Ursula Hauk, "Changing Patterns of Catholic Population in Eastern United States (1790–1950)," Doctoral Dissertation, Clark University, 1958.

fundamental data. As is the case with demographic materials in general, the collection of the basic information is a task beyond the capacities of the individual scholar, who must look to national and international agencies. These agencies have either neglected to assemble any data or have done so in ways that make their interpretation difficult, especially for international comparisons.[11] Secondly, there is the intractability of the material itself. Unlike some other demographic or cultural traits, religion is a many-sided phenomenon; some of its more important aspects are extremely difficult to define or measure, and others, such as personal attitudes on religious matters, are possibly beyond the scope of direct observation. Among the multiple definitions of religion we must include: a mental complex accessible only to the anthropologist, theologian, or psychologist; a highly diversified body of customs, some only quite indirectly related to theological concerns; a formal institution, i.e., church or denomination; and a group of persons sharing some degree of religious identity by virtue of tradition or common observance. This wide range of meanings leads, in turn, to a number of serious methodological problems. Should the geographer confine his interest to formal adherence to the various creeds? Or if he rejects this approach, how does he measure and study the intensity of religious belief and observance in all their endless ramifications? Is religion cause or effect in the cultural landscape, or somehow both? Should the geographer simply note the material manifestations of religion, as in the settlement landscape, economic processes, or political relations, or should he concentrate on the inward, spiritual aspects of what is essentially an incorporeal phenomenon?

Largely because of the difficulty of obtaining adequate data on other phases of religion or of making direct observations on its nonmaterial aspects, most of those geographers who have pioneered in the study of religion have had to restrict their attention to the effects of religious faith and practice on the cultural scene, especially architecture, urban and village morphology, and other phases of the settlement landscape.[12] In the present instance, lack of adequate background studies or good alternative sources of statistics have meant a study limited almost wholly to the analysis of the membership data reported by the various American religious denominations.

[11] The best recent compilation of statistics for religion on a world scale is United Nations, Department of Economic and Social Affairs, *Demographic Yearbook, 1956* (New York, 1956).

NATURE AND LIMITATIONS OF THE DATA[13]

The great bulk of our statistical data on religion in the United States has been collected and published by the Bureau of the Census. Beginning with the Seventh Census in 1850, information on churches was compiled in connection with each of the decennial enumerations until 1890, although the 1880 material never reached the publication stage. In 1906, the Bureau inaugurated a special Census of Religious Bodies which was continued at ten-year intervals until 1936.[14] It is generally believed that the 1926 Census was the most com-

[12] This is the prevailing theme in Deffontaines, *op. cit.* and also, for example, in Credner, *op. cit.* and Fickeler, *op. cit.* The best recent exposition of this concept is Erich Isaac, "Religion, Landscape and Space," *Landscape*, Vol. 9(Winter, 1959–1960), pp. 14–18.

[13] There is no single comprehensive bibliography of the statistical data and general literature on religion in the United States, but the best general guides are Benson Y. Landis, "A Guide to the Literature on Statistics of Religious Affiliation with References to Related Social Studies," *Journal of the American Statistical Association*, Vol. 54(1959), pp. 335–357 and Dorothy Good, "Questions on Religion in the United States Census," *Population Index*, Vol. 25 (1959), pp. 3–16. Valuable bibliographical material on immigrant religious communities can be found in Stanley J. Tracy, ed., *A Report on World Population Migrations, as Related to the United States of America* (Washington, 1956).

[14] The basic tabulations appear in the following publications:

Seventh Census of the United States: 1850, Table XIV, "Church Property, etc.," 1853.

Eight Census of the United States: 1860. Statistics of the United States (Including Mortality, Property, etc.) in 1860, 1866.

Ninth Census of the United States: 1870, Vol. I, Tables XL, XLI, XLII, 1872.

Eleventh Census of the United States: 1890, Vol IX, Report on Statistics of Churches in the United States, 1894.

Religious Bodies: 1906. Part I, Summary. Part 2, Separate Denominations, 2 vols., 1910.

Religious Bodies: 1916. Part 1, Summary. Part 2, Separate Denominations, 2 vols., 1919.

Religious Bodies: 1926. Vol. I, Summary, Vol. II, Separate Denominations, 2 vols., 1929–1930.

Religious Bodies: 1936. Vol. I, Summary. Vol. II, Statistics, History, Doctrine, Organization, and Work, 2 vols. in 3, 1941.

plete and successful in the series. The 1850, 1860, and 1870 enumerations resulted in the publication of information on the number and seating capacity of church edifices, as well as a variety of facts about finances, educational, missionary, and other activities of the denominations, but no statistics on membership. The earliest figures on number of members (for each denomination, on a county basis) appeared in the reports of the 1890 Census; and this material was published for all the subsequent Censuses of Religious Bodies.

In every instance, the Census canvass involved the procurement of information from the local congregation, at first by direct interrogation by an enumerator and later by means of mailed inquiries. No effort was ever made to ascertain the church affiliation or preference of individuals by including a religious query in the regular census schedule. A single attempt to do so on a sample basis in 1957 proved to be abortive.[15] The constitutional doctrine of the separation of church and state has come to be interpreted in many quarters as even prohibiting the collection by a government agency of any information concerning churches, much less any facts regarding the religious status of individuals.[16] It was apparently a growing sensitivity on this issue that led to a marked deterioration in the response to the 1936 canvass and the failure to publish the partial results of the 1946 Census of Religious Bodies or even to initiate one in 1956. With the withering away of the decennial Census of Religious Bodies and the failure, despite a concerted campaign, to have a question on religious preference included in the 1960 enumeration schedule, it is highly unlikely that any additional religious statistics will be issued by the Bureau of the Census until 1970, if then.

Critics of the various Census efforts to tally church membership have unanimously appraised them as seriously defective in terms of completeness, reliability, and comparability. These shortcomings stem from the highly variable responses of the thousands of local church officials involved and the many different criteria of church membership used by the various denominations. An additional factor, for which the Census officials are completely blameless, is the frequency with which religious bodies in the United States splinter, merge, change their names, simply vanish, and otherwise make it difficult to keep track of their identity from one enumeration to another. Since the latest official data, those for 1936, hardly seemed adequate in terms of quality or timeliness for a useful study of contemporary patterns of church membership, it was decided to utilize the results of a major private effort to collect comprehensive statistics on American church membership, the National Council of Churches of Christ in the U. S. A.'s *Churches and Church Membership in the United States: an Enumeration and Analysis by Counties, States, and Regions.*[17] Our complete reliance on this source makes it essential to understand the methods used to assemble the data and their virtues and limitations before we can proceed with any geographical analysis.

Churches and Church Membership in the United States is a compilation of statistics on number of churches and church members, by county, submitted by the national headquarters of the various participating religious bodies listed in the 1953 *Yearbook of American Churches*[18] for the year 1952 or the nearest

[15] Only a portion of the material that had been collected and analyzed had appeared ("Religion Reported by the Civilian Population of the United States: March, 1957," *Current Population Reports*, Series P-20, Population Characteristics, No. 79, Washington, Feb. 2, 1958) before the Bureau decided to suspend further publication.

[16] For strong arguments against this interpretation, see Smith, *op. cit.*, pp. 175–176, Good, *op. cit.*, Bogue, *op. cit.*, pp. 688–689, and Otis Dudley Duncan, "Report of the Committee on the 1960 Census, Population Association of America," *Population Index*, Vol. 23(1957), pp. 293–305.

[17] Published in New York (1956–1958) in a total of 80 bulletins arranged in the following series: Series A, Major Faiths by Regions, Divisions, and States; Series B, Denominational Statistics by Regions, Divisions, and States; Series C, Denominational Statistics by States and Counties; Series D, Denominational Statistics by Standard Metropolitan Areas; and Series E, Analysis of Socio-Economic Characteristics. This survey is briefly described in Wilbur Zelinsky, "The Religious Composition of the American Population," *Geographical Review*, Vol. 50(1960), pp. 272–273. It should also be noted that for some years the National Council of Churches has also been publishing figures on the total membership of all religious bodies making such data available. The latest such compilation appears in *Yearbook of American Churches . . . 28th Issue, Annual Edition for 1960*, edited by B. Y. Landis (New York, 1959).

[18] New York, National Council of Churches, 1953.

practicable date.[19] Out of the 251 religious bodies reported in the *Yearbook*, accounting for 92,546,000 members in 285,277 local churches, 112 bodies, with 74,125,462 members in 182,856 churches, were able and willing to participate. Most of the non-participating bodies are relatively small or were unable to supply information because of the lack of centralized records.[20] The largest block of missing members, an estimated 9,392,694 persons, is accounted for by five important, but loosely organized Negro groups—two Baptist and three Methodist bodies—in the Southern states, which include a large majority of all Negro church members in the United States. The subsequent discussion is thus largely, but not entirely, confined to the white church membership of the nation. Another predominantly Southern group, the Churches of Christ, with an estimated 1,500,000 members, was not reported; and since less than one percent of the estimated 2,720,739 members of the various Eastern Orthodox, Old Catholic, and Polish National Catholic churches were tabulated, they are omitted from further consideration here. The Church of Christ Scientist, whose 1936 membership was estimated at 268,915 has a regulation that forbids "the numbering of people and reporting of such statistics for publication." In the case of the Church of Jesus Christ of Latter-day Saints, some 230,956 of the 1,077,285 members reported for 1952 could not be assigned to any geographic "stakes" and hence are omitted from the tabulations. Nearly half the Roman Catholic county figures were estimated on the basis of a formula derived from known diocesan totals, and are substantially less reliable than the balance of the county data.

The count of members was reported to the National Council of Churches under the several definitions of the participating bodies; and the variety of these definitions is the major source of the non-comparability of the denominational groups employed in this study. Here we cannot do better than to quote from the introductory material in *Churches and Church Membership in the United States*:

> For those bodies having several membership categories (e.g., baptized, confirmed, communicant), the most inclusive category was generally reported. . . . The Roman Catholics count all baptized persons, including infants. The Jews regard as members all Jews in communities having congregations. . . . Most Protestant bodies count only the persons who have attained full membership, and previous estimates have indicated that all but a small minority of these are over 13 years of age. However, many Lutheran bodies and the Protestant Episcopal Church now report all baptized persons, and not only those confirmed. It is also known that the Church of Jesus Christ of Latter-day Saints includes in its membership children of about eight years of age.

Comparison or correlation of membership statistics with 1950 Census data is hampered by the fact that the place of membership is established by the location of the church and not by the actual residence of the member. Although there is no way of ascertaining their location or the effects of this situation in a cartographic analysis, there are undoubtedly numerous cases where a significant number of members are reported for counties in which they do not reside.

In addition to the problems created by the omission of a good many religious bodies, the variety of membership criteria used, and the lack of complete correspondence between place of membership and place of residence, we also have the fact that the data are not entirely simultaneous, but range from 1951 to early 1954 with a heavy concentration in 1952 and that a significant, but undetermined degree of undercounting and overcounting occurred in the coverage of some localities and groups in spite of careful checking and editing of the raw data. Nevertheless, a comparison of the material provided by *Churches and Church Membership in the United States* with that in the 1936 Census of Religious Bodies leads to the firm conclusion that the former is superior in terms of both completeness and quality of data. Although the later study lacks the wide range of subject matter covered by the 1936 canvass, the use of centralized sources and other methodological refinements eliminated much of the variability and incompleteness of response. Local analysis is facilitated by the

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[19] The purposes, methodology, and problems involved in the survey are described in Series A, Bulletin No. 1 in *Churches and Church Membership in the United States*.

[20] These 251 religious bodies do not necessarily comprise the totality of religious groups in the United States. It is quite likely that there existed in the United States in 1952 an additional several score of small, ephemeral, local, or poorly organized groups which were not reported in the *Yearbook of American Churches*.

publication of county data for all religious groups, whereas county figures were made available only for the major denominations in the tables published by the 1936 Census of Religious Bodies.

PLAN OF STUDY

Since it is obviously impractical to deal individually with each of the 112 religious bodies for which data are furnished in *Churches and Church Membership in the United States*, it was decided to combine various bodies of common origin or close affinity into a relatively small number of denominational groups.[21] In performing this operation, I have followed the system employed in the statistical tabulations of the *Yearbook of American Churches*, which involves a combination of historical and theological factors. Twenty-two groups, comprising 80 religious bodies, were selected for further analysis: those twenty denominational groups having a total reported membership in excess of 100,000 each and two smaller groups —the Friends and the Moravian Bodies—of especial historical and geographical interest (the first 22 groups listed in Column 1 of Table 1).[22] The remaining 32 religious bodies, which have an average membership of less than 12,000 and are of marginal interest at best, have been omitted from further discussion. In spite of their recent merger, the Congregational Christian Churches and the Evangelical and Reformed Church are so distinctive in terms of origin, geographical pattern, his-

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[21] At this point a bibliographical note on the major descriptive and historical surveys of American denominations may be in order. The *Yearbook of American Churches* contains brief historical and organizational notes on each religious body, in addition to the statistics already mentioned. The best general guide is probably Frank S. Mead, *Handbook of Denominations in the United States*, rev. ed. (New York, 1956); but it can be usefully supplemented by F. E. Mayer, *The Religious Bodies of America*, 2nd ed. (St. Louis, 1956). Valuable essays on the leading Protestant denominations are to be found in Vergilius Ferm, ed., *The American Church of the Protestant Heritage* (New York, 1953). Four of the most useful histories and general analyses of the religious situation in the United States are: Kenneth Scott Latourette, *A History of the Expansion of Christianity. Volume IV. The Great Century, A. D. 1800—A. D. 1914, Europe and the United States of America* (New York, 1941); Willard L. Sperry, *Religion in America* (Cambridge, 1946); Anson Phelp Stokes, *Church and State in the United States*, 3 vols. (New York, 1950); and William Warren Sweet, *The Story of Religion in America* (New York, 1950).

[22] The following is an alphabetical listing of the denominational groups and their component religious bodies. It should be noted again that many religious bodies that would have been included within these groups do not appear because of the unavailability of statistical data.

Adventist Bodies.—Seventh Day Adventists, Advent Christian Church, Life and Advent Union.

Assemblies of God.

Baptist Bodies. — American Baptist Convention, Southern Baptist Convention, Baptist General Conference of America, Christian Unity Baptist Association, North American Baptist General Conference, Seventh Day Baptist General Conference, United Baptists.

Brethren.—Church of the Brethren, Brethren Church (Ashland, Ohio), Brethren Church (Progressive), Church of God (New Dunkards), Plymouth Brethren, Brethren in Christ.

Churches of God.—Church of God (Cleveland, Tenn.), Church of God (Anderson, Ind.), Church of God in Christ.

Congregational Christian Churches.

Disciples of Christ, International Convention.

Evangelical and Reformed Church.

Evangelical United Brethren Church.

Friends.—Religious Society of Friends (Conservative), Religious Society of Friends (General Conference), Five Year Meeting of Friends, Religious Society of Friends (Philadelphia and Vicinity), Central Yearly Meeting of Friends, Oregon Yearly Meeting of Friends Church, Pacific Yearly Meeting of Friends.

Jewish Congregations.

Latter-day Saints.—Church of Jesus Christ of Latter-day Saints, Reorganized Church of Jesus Christ of Latter-day Saints, Church of Jesus Christ (Bickertonites), Church of Jesus Christ (Cutlerites).

Lutheran Bodies. — American Lutheran Church, Augustana Evangelical Lutheran Church, Evangelical Lutheran Church, Lutheran Church-Missouri Synod, Evangelical Lutheran Joint Synod of Wisconsin and Other States, United Lutheran Church in America, United Evangelical Lutheran Church, Slovak Evangelical Lutheran Church, Negro Missions (Lutheran), Church of the Lutheran Brethren of America, American Evangelical Lutheran Church, Evangelical Lutheran Church in America (Eilsen Synod), Finnish Apostolic Lutheran Church of America, Finnish Evangelical Lutheran Church (Suomi Synod).

Mennonite Bodies.—Conference of the Evangelical Mennonite Church, Conservative Mennonite Conferernce, Hutterian Brethren, Mennonite Brethren Church of North America, Mennonite Church, Old Order Amish Mennonite Church, Old Order (Wisler) Mennonite Church, Reformed Mennonite Church, Stauffer Mennonite Church.

Methodist Bodies.—The Methodist Church, Free Methodist Church of North America, Holiness Methodist Church, Lumber River Annual Conference of the Holiness Methodist Church, Primitive Methodist Church, U. S. A., Reformed Zion Union Apostolic Church, Wesleyan Methodist Church of America.

TABLE 1.—UNITED STATES, REPORTED MEMBERSHIP IN RELIGIOUS BODIES

Religious body	National council of churches survey—"Churches and Church Membership" (1952)[1]	Membership reported for 1952 in "Yearbook of American Churches"[2]	Current population survey, March, 1957[3] (persons 14 years old and over)
Roman Catholic	29,688,058	30,253,427	30,669,000
Baptist Bodies	9,795,782	17,470,111	23,525,000
Methodist Bodies	8,892,869	11,664,978	16,676,000
Lutheran Bodies	6,418,269	6,313,892	8,417,000
Jewish Congregations	5,112,024	5,000,000	3,868,000
Presbyterian Bodies	3,532,176	3,535,171	6,656,000
Protestant Episcopal	2,544,320	2,482,887	—
Disciples of Christ	1,836,104	1,815,627	—
Congregational Christian	1,263,472	1,269,466	—
Latter-day Saints (Mormons)	953,588	1,210,336	—
Evangelical & Reformed	750,463	751,003	—
Evangelical United Brethren	722,966	724,055	—
Assemblies of God	459,256	370,118	—
Reformed Bodies	349,164	373,780	—
Adventist Bodies	283,516	290,898	—
Church of the Nazarene	249,033	243,152	—
Churches of God	241,966	305,043	—
Brethren Churches	232,569	256,525	—
Unitarian & Universalist	159,904	158,402	—
Mennonite Bodies	100,925	142,513	—
Friends (Quakers)	96,451	114,119	—
Moravian Bodies	48,843	54,505	—
Eastern Churches	13,169	2,353,783	—
Churches of Christ	—	1,500,000	—
Christian Unity Science Church	—	1,112,123	—
Church of God in Christ	—	328,304	—
Pentecostal Assemblies	41,555	300,070	—
Church of Christ Scientist	—	268,915 (1936)	—
Polish National Catholic Church	—	265,879	—
Salvation Army	—	232,631	—
International General Assembly of Spiritualists	—	157,000	—
Old Catholic Churches	1,471	101,077	—
Federated Churches	—	88,411	—
International Church of the Foursquare Gospel	66,191	78,471	—
Apostolic Overcoming Church of God	—	75,000	—
Other Bodies	261,358	593,017	25,223,000
TOTAL	74,125,462	92,546,000	115,034,000

[1] Includes only those groups reporting membership by county.
[2] Includes all groups reporting total national membership.
[3] Reports religious affiliation or identification rather than formal membership.

Moravian Bodies.—Bohemian and Moravian Brethren, Moravian Church in America.

Presbyterian Bodies.—Presbyterian Church in the U. S., Presbyterian Church in the U. S. A., United Presbyterian Church of North America, Associated Presbyterian Church of N. A., Cumberland Presbyterian Church.

Protestant Episcopal Church.

Reformed Bodies.—Christian Reformed Church, Reformed Church in America.

Roman Catholic Church.

Unitarian-Universalist Church.—Unitarian Churches, Universalist Church of America.

tory, and ethnic affiliation that little would have been gained and a great deal lost, for the purposes of this study, by combining them into a single denominational group. On the other hand, the Unitarian and Universalist bodies would have been combined into a single group because of their pronounced similarities even if their recent union had not taken place.[23] The subsequent discussion will show that it has proved profitable, for purposes of geographical analysis, to arrange the 22 major denominational groups into three broad classes in terms of provenience: those of British colonial origin, groups introduced by immigration from the European continent, and those bodies originating in the United States.[24] The classification is as follows:

I. British Colonial Groups

Protestant Episcopal	Congregational Christian
Presbyterian Bodies	Baptist Bodies
Methodist Bodies	Friends

II. Immigrant European Groups

Roman Catholic	Reformed Bodies
Jewish Congregations	Bretheren Churches
Lutheran Bodies	Mennonite Bodies
Evangelical and Reformed	Moravian Bodies

III. Native American Groups

Disciples of Christ	Church of the Nazarene
Unitarian and Universalist Churches	Assemblies of God
	Churches of God
Latter-day Saints	Evangelical United Brethren
Adventist Bodies	

An explanatory note concerning the maps that are the principal means for analyzing the denominational data may be useful to the reader. It was immediately apparent that the statistics on church membership are of much greater geographic, cultural, and demographic significance than those on the number of churches; and there was no difficulty in deciding that the limitations in the completeness and quality of the data precluded the possibility of any useful series of maps showing the relative strength, i.e., percentage within total population or of total church membership, of the various denominational groups. Consequently, the best cartographic expedient was clearly a set of maps showing the distribution of absolute numbers of reported members of the various denominational groups on the basis of counties and Standard Metropolitan Areas. It is interesting to note that the only two previous efforts to map the religious composition of the American population in any detail adopted quite different techniques. In *The Atlas of the Historical Geography of the United States*, the distribution of churches, i.e., congregations, is shown for the leading denominations in 1775–1776, 1860, and 1890, for lack of any alternative data in the case of the first two dates and for the sake of consistency in the case of the last.[25] A statistical atlas published by the U. S. Census Office in 1898 has a series of choropleth maps depicting the proportion of the members of the eight leading denominations to the aggregate population by county and state in 1890 and shows the same ratio for eight lesser denominations by state only.[26] In spite of the

[23] During the early stages of this study, serious consideration was given to the possibility of extending the study area northward to include Canada and its excellent census statistics on religious preference. This idea was discarded because of the problem caused by the different dates of the American and Canadian statistics, the completely different methods used in defining religious affiliation and gathering data, and the lack of identity, in some instances, between denominations separated by the international boundary. The reader may, however, find it worth his while to examine the maps of the six leading Canadian denominations (Roman Catholic, Anglican, Baptist, United Church of Canada, Presbyterian, and Lutheran) appearing in the *Atlas of Canada* (Ottawa: Department of Mines and Surveys, Geography Branch, 1957) alongside those accompanying this study. There is much less to be gained by comparing the religious patterns of the United States and Mexico, since the latter's 1950 census indicates that more than 98 percent of the population adheres to the Catholic faith.

[24] A classification based on theological orientation, such as the eleven categories utilized by Mayer, *op. cit.* was briefly considered and abandoned.

[25] Charles O. Paullin, *Atlas of the Historical Geography of the United States* (Washington and New York, 1932), pp. 49–51 and Plates 82 to 88.

[26] U. S. Census Office, *Statistical Atlas of the United States, Based Upon the Results of the Eleventh Census* (Washington, 1898), Plates 34 to 40. Additional maps and graphs, of less general utility, appear in U. S. Census Office, *Statistical Atlas of the United States Based on the Results of the Ninth Census of 1870* (Washington, 1874), in which Plate XXXI contains a series of graphs showing "Ratio of Church Accommodations to the Total Population over 10 Years of Age," by state and territory for the eleven leading denominations, and U. S. Bureau of the Census, *Statistical Atlas of the United States* (Washington, 1914), in which Plates 479 to 492 contain graphs and maps showing the characteristics and distribution, by state, of the major denominations in 1906. Maps of the Roman Catholic population in the Atlantic Seaboard states in 1790, 1820, 1860, 1890, 1920, and 1950 appear in Hauk, *op. cit.*, pp. 53–58.

great differences in kinds of data and methods of representation, comparisons between the earlier and the present series of maps are most instructive.

For all their shortcomings, the statistics presented in *Churches and Church Membership in the United States* have been accepted at face value in constructing the maps, except in two cases where major gaps in the data would have caused serious distortion in the resultant map patterns. The Roman Catholic membership in several counties, including Webb (Laredo), within the Corpus Christi Diocese, which was grossly under-reported in the National Council of Churches' tables, has been estimated on the basis of information supplied by the diocesan chancery; and the omission of figures on the members of the Protestant Episcopal Church in its Sacramento (Northern California) Diocese has been rectified by reference to the *Episcopal Church Annual.* There are many other obvious lesser discrepancies in the statistics, as for example the reporting of only 502 members of Methodist bodies in Lucas County (Toledo), Ohio, or only 48 Methodists in Wake County (Raleigh), North Carolina; but it was felt that any tampering with the figures without a thorough investigation involving extensive correspondence and field work might well have done more harm than good.

The choice of the symbols used in the maps and their quantitative equivalents involved a considerable amount of experimentation. The extremely uneven distribution of human populations, and specifically the heaping up of great masses of persons within relatively minute urban areas and the thin dispersion of small numbers in many extensive rural areas, poses a problem for the cartographer for which there seems to be no truly satisfactory solution. In the present instance, it was decided to use shaded three-dimensional symbols to represent the larger values and open circles for the lesser ones. For the ten smallest denominational groups, the number of reported members in each county or SMA with a total of 1,000 or more is shown by means of a cube,[27] the volume of which is proportional to the value in question, while the area of the open circle is scaled to values ranging from one member through 999. The numerical equivalents of the symbols were doubled for all the larger denominational groups, except the Roman Catholic, so that the smallest cubical symbol represents 2,000 members and the others range proportionately higher. In the case of Roman Catholics, the uniquely large volume of membership necessitated much higher equivalents for the symbols—five times those used for the smaller denominational groups, or two and one half times those used for the others. The final choice of values for the symbols represents an attempt to reconcile three rather contradictory purposes: to render legibly the number and location of members in thinly occupied areas; to avoid excessive congestion and overlapping of symbols in areas of concentrated membership; and to make possible realistic comparisons among the various maps using the same values for their symbols.[28]

[27] The cube offers two major advantages as compared to the rather more popular sphere. Its drafting is much less difficult, and its mensurability, whether casually by eye or precisely by means of a rule, is considerably greater.

HISTORICAL CONSIDERATIONS

It is neither feasible nor necessary here to chronicle the complex histories of all the denominations with which we are concerned. But it is essential to sketch some of the broader historical conditions and trends governing the evolution of America's religious life if we are to appreciate the place of the church in our cultural landscape or make much sense of the contemporary distribution of denominations. During the first two centuries of settlement, the overwhelming majority of the immigrants who entered the United States were drawn from the United Kingdom. The remainder of the white settlers were largely derived from German-speaking areas, principally the Rhineland, or the Netherlands, with only trifling additions from other sections of the European continent.[29] It is hardly surprising, then, to dis-

[28] In some of the more congested maps, particularly the Baptist and Methodist, a number of smaller symbols have been omitted from extremely crowded areas where their inclusion would have seriously impaired legibility without adding much useful information.

[29] If we ignore the substantial influx of Negro slaves into the United States, it is only because this movement had little, if any, direct impact upon the religious scene during the earlier periods of American history and because the limitations of our statistical source oblige us to bypass almost completely the topic of Negro religious affiliation.

cover that all the principal British sects had made the trans-Atlantic journey and were liberally represented during the later phases of American colonial history, or that several denominations of German and Dutch origin were firmly established in various corners of British North America. It is almost certain, however, that there was no faithful reproduction of the British religious scene in the New World. Although it is quite easy to exaggerate the influence of religious nonconformity in generating movement to America, it is still undoubtedly true that dissenters from the established churches of Great Britain and certain continental countries accounted for a disproportionately large share of the arrivals. This fact clearly stands out in the following tabulation of congregations existing in the United States in 1775–76 that Paullin was able to identify and locate geographically in his remarkable analysis of colonial documents:[30]

Congregational	668	Moravian	31
Presbyterian	588	Congregational–Separatist	24
Episcopalian	495	Mennonite	16
Baptist	494	French Protestant	7
Friends	310	Sandemanian	6
German Reformed	159	Jewish	5
Lutheran	150	Rogerene	3
Dutch Reformed	120	Others	31
Methodist	65		
Catholic	56	TOTAL	3,228

Unfortunately, we have no comparable statistics for the contemporary religious composition of the British population to set alongside these figures; but it is unquestionable that the "Established," i.e., Episcopal, Church was much feebler on the western side of the Atlantic than in Great Britain. Indeed, one of the central facts of American religious history is the failure of any genuine established church to appear, in spite of tentative efforts on the part of the British Crown and some of the colonial administrations. As a consequence of this, we can note not only the early appearance of a strong denominational diversity but also a freedom to experiment with new modes of religious experience and organization — or to abstain entirely from formal religious adherence. The Great Awakening that reached American shores after bursting forth in mid-eighteenth century England may well have planted some of the seeds that were later to blossom into a spectacular profusion of denominations; but there were already signs of great ferment among various German and Dutch Protestant congregations. The unsettling effects of the English Civil War, the great difficulty of effectively controlling American congregations across a distance of 3,000 miles, the sharply disruptive effects of the War of Independence, the establishment of the doctrine of the separation of church and state, and, above all, the completely novel social and economic conditions of a rapidly moving frontier all played their part in giving a new coloration and pattern to imported creeds and in spawning the abundance of native American denominations that have never left off their fissiparous ways since the last quarter of the eighteenth century. The same factors that favored variety in religious affiliation also permitted a high incidence of dissociation from formal religious ties or simple lack of interest in spiritual affairs. We are on exceedingly shaky statistical grounds in estimating the ratio of church members to non-members in the early days of the Republic; but most scholars agree that a low point was reached in that period and that the trend has been rather steadily upward ever since.[31] Whatever their origin, a large multitude of the unchurched abounded in the United States at the end of the 1700's and provided a fertile missionary field during the

[30] Paullin, *op. cit.*, p. 50.

[31] Latourette, *op. cit.*, p. 177, states church membership at 5.0 percent of total population in 1790 and 6.9 percent in 1800, but without citing any authority. These figures seem unacceptably low, even allowing for a great dropping off in church membership during the Revolutionary period. If we apply the current average of about 387 members per church, a not unreasonable figure for the late colonial period, to the admittedly incomplete total of 3,228 churches counted by Paullin and Wright for 1775–76, we obtain 1,249,000 church members or some 48.6 percent of the estimated total population of that time. A progressive rise in church membership during the past hundred years is quite plausible. Latourette estimates that some 15.5 percent of the American population were church members in 1850. Census statistics indicate a gradual rise in this index, from 32.7 to 43.6 percent between 1890 and 1936. The latest available figure on total church membership is 109,557,741 for 1958 (1960 edition of *Yearbook of American Churches*), or 63.0 percent of the total population. It is only fair to state that many acute observers of the current religious scene do not equate this boom in church membership with a genuine revival in religious fervor.

Second Great Awakening in the opening years of the nineteenth century not only for the traditional denominations but for a variety of new ones as well.

The maps of the 1775–76 distribution of American churches furnished by Paullin distinctly foreshadow later regional concentrations. The Congregationalists were powerful in New England, but were infrequently found elsewhere; the Episcopalians, though occurring over a wide area, were most strongly entrenched in Virginia, Maryland, Connecticut, and New York; the Friends, also widely dispersed, were centered primarily in southeastern Pennsylvania and adjacent sections of New Jersey; the Presbyterians were well represented almost everywhere except southern New England, but were most prominent in the newly settled western fringes of the Atlantic Seaboard states; the Dutch Reformed and the various Teutonic churches were strong and even dominant in various sections of New York, Pennsylvania, and the Maryland and Carolina Piedmont. Only the Baptists, who were well nigh universally, if thinly, distributed, had failed to show the regional gravitation that was to become so well marked in their subsequent history. Methodism was still too young and weak in America to have achieved any real regional pattern, but incipient clusters in Maryland and New Jersey faintly reveal the shape of things to come. The minute Roman Catholic population—only an estimated 32,500 in 1784[32]—was confined to relatively libertarian Maryland, Pennsylvania, Delaware, and New Jersey; the few isolated Jewish congregations bear little relevance to later developments.

After the Atlantic Seaboard had been fully occupied and the principal denominations had begun to sort themselves out regionally, four major processes were to shape the present-day areal patterns of religious allegiance in the United States: (1) the westward thrust of the frontier and the differential fortunes of the colonial British and Teutonic churches in claiming the vast, ecclesiastically virgin territories of the central and western states; (2) the rise, growth, and wide dispersion of a number of native American denominations; (3) the great new flood of immigration beginning in the 1830's with Irish Catholics and both Catholic and Protestant Germans and followed soon after by adherents of numerous denominations from Scandinavia, Eastern Europe, and Southern Europe; and, finally, (4) the great tides of internal migration that have constantly re-grouped the inhabitants and, hence, the religious map of perhaps the most mobile nation of modern times. These are themes that can be most fruitfully pursued in our subsequent discussion; but it is interesting to note the common element of swift movement. There are persistent, relatively stable features in the spatial disposition of some religious bodies, but more important is the phenomenon of constant and rapid change, the restless shifting of forces, the transmutation and re-shaping of regions, and thus the provisional configuration of current patterns. Although critics of American civilization may, with considerable justice, accuse it of being grossly secular, we may note the paradoxical fact, too little studied by cultural historians, of those of our native churches and some revitalized groups of European vintage which have generated especially great momentum, carrying their missionary message not only to the non-Christian sections of the world but to the British Commonwealth and Europe as well. We have, then, a religiously dynamic and complex United States functioning as a hearth area for elements of non-material culture, i.e., new forms of religious worship and concepts of salvation, in addition to the many advanced forms of material technology, for which the nation has received vastly more publicity.

INCIDENCE OF CHURCH MEMBERSHIP

One of the significant background facts to be borne in mind during the subsequent discussion is the great variation among states and counties in the percentage of population reported as members of religious bodies. Although we are exposed to the vagaries of inconsistent and incomplete statistics, certain broad generalizations can be sustained. The incidence of church membership is highest in those areas, particularly in the Northeast, where settlement is old, dense, and stable and where strongly organized denominations, especially the Roman Catholic, are well represented (Table 2). It is lowest in those places with heavy in-migration — and thus a temporary loosening of church associations—

[32] Hauk, *op. cit.*, p. 34.

TABLE 2.—REPORTED CHURCH MEMBERSHIP AS PERCENTAGE OF TOTAL POPULATION

UNITED STATES	49.2	*South Atlantic* (cont.)	
New England	62.5	Virginia	38.5
Maine	41.2	West Virginia	32.8
New Hampshire	53.0	North Carolina	39.9
Vermont	52.7	South Carolina	40.0
Massachusetts	67.1	Georgia	38.3
Rhode Island	75.7	Florida	36.4
Connecticut	60.5	*East South Central*	38.6
Middle Atlantic	59.3	Kentucky	44.8
New York	60.1	Tennessee	40.2
New Jersey	57.6	Alabama	34.2
Pennsylvania	58.9	Mississippi	33.9
East North Central	49.2	*West South Central*	49.0
Ohio	46.4	Arkansas	31.3
Indiana	43.6	Louisiana	53.7
Illinois	53.6	Oklahoma	42.4
Michigan	42.3	Texas	53.6
Wisconsin	63.8	*Mountain*	50.4
West North Central	53.6	Montana	46.7
Minnesota	61.6	Idaho	44.1
Iowa	53.6	Wyoming	43.6
Missouri	48.9	Colorado	41.6
North Dakota	63.0	New Mexico	64.9
South Dakota	58.4	Arizona	44.9
Nebraska	53.4	Utah	73.3
Kansas	46.6	Nevada	37.6
South Atlantic	39.5	*Pacific*	37.7
Delaware	44.3	Washington	30.5
Maryland	47.7	Oregon	27.7
District of Columbia	46.6	California	40.7

Source: *Churches and Church Membership in the United States*, Series A, No. 3, Table 4.

such as California, Washington, Oregon, Nevada, or Florida — or those areas which are relatively inaccessible, thinly settled, or characterized by low incomes. The low ranking of the Mountain states — except for strongly Catholic New Mexico and strongly Mormon Utah — is readily explained in these terms. The poor showing of the Southern states in Table 2 is, in large part, the result of excluding the great bulk of Negro church members from the reckoning. Church members account for 53.9 percent of the white population of the South, only slightly less than the corresponding statistic — 54.6 percent — for the nation as a whole. The state figures do, however, mask an interesting differential between lowland and upland tracts that appears in such states as Virginia, Kentucky, Tennessee, West Virginia, Georgia, Alabama, and Arkansas.[33] The low percentages reported for the poor, remote, and often thinly occupied areas of high or rugged terrain doubtless reflect the difficulties for actual or potential congregations; but they also quite probably indicate the relative importance in such areas of autonomous, rather tentatively organized groups, largely oriented toward the fundamentalist theology and largely unreported in our statistics.

URBAN–RURAL DIFFERENTIALS

Another major distributional phenomenon that does not appear in our map series is the difference in the strength of membership in the various denominational groups as between urban and rural areas. Our statistical source indicates that 60.8 percent of the reported church members of the nation in 1952 were accounted for by the 168 Standard Metropolitan Areas in which 56.8 percent of the population resided in 1950. It is not at all clear whether church membership in the United States is actually more urbanized than the population in general or whether these figures simply reflect under-enumeration of church members in rural tracts and the absence from our statistics of several important, essentially rural religious bodies. There are, however, emphatic differences in the degree to which the membership of the individual denominational groups is urban or rural (Table 3). If we accept our figures at face value, 97.5 percent of the American Jewish population is to be found within metropolitan areas, 2.5 percent in intermediate counties (those containing one or more urban places, but not constituting part of a metropolitan area), and none at all in the purely rural counties.[34] The members of the Roman Catholic and Protestant Episcopal churches are also highly urbanized, with 74.5 and 72.7 percent, respectively, in metropolitan areas and only 2.4 and 2.1 percent in rural counties; and the much

[33] The bulletins in Series C of *Churches and Church Membership in the United States* contain maps showing "Reported Church Membership of Major Faiths as Percent of Total Population," by county for each state.

[34] In actuality, there are a small number of Jews, almost certainly well below one percent of the national total, who reside in rural counties, principally as rural nonfarm persons, but are unreported, largely because there is no organized congregation in the vicinity.

TABLE 3.—DENOMINATIONAL GROUPS BY PERCENTAGE OF REPORTED MEMBERS IN METROPOLITAN AND NON-METROPOLITAN AREAS, CA. 1952

Denominational group	Metropolitan counties	Non-metropolitan counties	
		Intermediate counties	Rural counties
Jewish Congregations	97.5	2.5	0
Roman Catholic	74.5	23.0	2.4
Reported members of all Protestant Groups	45.6	45.3	9.0
Unitarian and Universalist Churches	74.4	25.6	
Protestant Episcopal	72.8	25.1	2.1
Moravian Bodies	70.3	29.7	
Congregational Christian Church	59.9	34.9	5.1
Evangelical and Reformed	59.5	37.0	3.5
Presbyterian Bodies	58.1	37.6	4.3
Reformed Bodies	54.9	45.1	
Assemblies of God	54.5	45.5	
Adventist Bodies	52.1	47.9	
Lutheran Bodies	51.1	40.5	8.4
Latter-day Saints	45.8	44.5	9.8
Friends	44.8	55.2	
Church of the Nazarene	43.8	56.2	
Evangelical United Brethren	42.0	50.6	7.4
Methodist Bodies	40.1	49.8	10.1
Mennonite Bodies	37.9	62.1	
Disciples of Christ	36.0	53.3	10.7
Brethren Churches	35.7	64.3	
Baptist Bodies	34.9	52.2	12.9
Churches of God	34.6	65.4	
Total Reported Church Members	60.8	33.5	5.8
United States population, 1950	56.8	36.4	6.8

Source: *Churches and Church Membership in the United States*, Series D, Nos. 3 to 6, Tables 136 to 139 and Series E, No. 1, Table 140.

smaller membership in the Unitarian–Universalist group shows the same predilection for cities.[35] At the opposite extreme the Disciples of Christ, Churches of God, Brethren, Baptist, and Mennonite bodies look to non-metropolitan counties for more than 60 percent of their membership. Five other groups — Lutheran bodies, Latter-day Saints, Friends, Church of the Nazarene, and Evangelical United Brethren — are essentially rural with metropolitan counties making up only 40 to 50 percent of the membership. The remaining six groups—the Congregational Christian Church, Evangelical and Reformed Church, Presbyterian bodies, Reformed bodies, Assemblies of God, and Adventist bodies—approach the national average in the residential composition of their membership. These national averages should be interpreted with caution since there are such significant local departures from the national pattern, as for example, substantial rural Catholic populations in various parts of the Middle West, strong rural concentrations of Episcopalians in Virginia, or a largely urban Baptist population in California. It should also be noted that despite their considerable absolute magnitude and decidedly urban character, the Catholic and Jewish groups nowhere dominate the population of metropolitan areas as overwhelmingly as do the Protestant groups in most urban areas in the Southeast (Table 4).

[35] The high incidence of urban residence indicated for the Moravians is a statistical fluke. Most of the members of this small group happen to reside in the outer, strictly rural sections of five SMA's.

OTHER GENERAL DISTRIBUTIONAL CHARACTERISTICS

We have already touched on the fact that the number and diversity of denominations in the predominantly Protestant United States is unmatched in any other nation. This diversity is apparent even within a small rural county or urban community where it is not uncommon for a dozen or more denominations to be represented by formal congregations; and in the larger cities the number of distinct religious bodies may run to several score. This rampant "over-churching" may, incidentally, be one of the by-products of an unusually productive economy, since it is difficult to see how a less prosperous nation could afford to support such an obvious surplus of religious accommodations.[36] One of the surprising facts about the American religious scene, one that does not necessarily follow from the multiplicity of denominations, is the extent to which most of the major groups tend to be national in distribution. No two of the areal patterns closely resemble each other, and each of the denominational groups does have one or more regional con-

[36] The relatively small number of denominations with significant contingents in the Southern states may, in part, reflect the less advanced condition of the Southern economy; but it is also the result of defects in the data collected by the National Council of Churches and of the general weakness of migratory movement into the region.

TABLE 4.—LEADING PROTESTANT, ROMAN CATHOLIC, AND JEWISH STANDARD METROPOLITAN AREAS, AS RANKED IN TERMS OF TOTAL REPORTED CHURCH MEMBERS, CA. 1952

Protestant		Roman Catholic		Jewish	
1. Winston-Salem, N. C.	98.2	Laredo, Texas (est.)	93.1	New York–Northeastern New Jersey	33.1
2. Gadsden, Alabama	97.6	Fall River–New Bedford, Mass.	80.2	Miami, Florida	29.2
3. Knoxville, Tenn.	97.3	Dubuque, Iowa	78.7	Los Angeles, Calif.	18.0
4. Greenville, S. C.	97.0	Manchester, N. H.	78.6	Atlantic City, N. J.	16.5
5. Greensboro-High Point, N. C.	96.6	Providence, R. I.	78.5	Philadelphia, Pa.	12.8
6. Raleigh, N. C.	96.5	New Orleans, La.	76.9	Baltimore, Maryland	11.8
7. Asheville, N. C.	96.2	Springfield-Holyoke, Massachusetts	75.4	Chicago, Illinois	11.4
8. Charlotte, N. C.	95.8	Albuquerque, N. M.	73.9	Cleveland, Ohio	10.8
9. Durham, N. C.	95.6	El Paso, Texas	73.2	Hartford–New Haven-Bristol, Conn.	9.3
10. Columbus, Georgia	95.0	Green Bay, Wisconsin	72.9	Boston–Lowell–Lawrence, Mass.	8.4

Source: *Churches and Church Membership in the United States*, Series D, Nos. 1 and 2, Tables 133 and 134.

centrations; but each of the larger groups tends to reach into every corner of the land, however unevenly. Thirteen of the 22 groups studied here (including the Roman Catholic and Jewish) are established in each of the 48 states,[37] and the remaining nine are among the smallest in terms of membership. However, even the latter groups are dispersed quite widely, so that we find the most areally limited of all—the Moravians—in no less than fourteen states. There has evidently been unusual mobility of people and of religious ideas, with no successful creed limited to a single minor segment of the national territory. Even the Latter-day Saints, who are so nearly synonymous with Utah and some adjacent areas and dominate their region to a degree unparalleled elsewhere, are present in moderate numbers in many other sections of the country.

This strong tendency toward national occurrence among most of the denominational groups is given quantitative expression in Tables 5 and 6. The coefficient of geographic association (g),[38] which has been computed by denominational group and by state, is the total church membership of a state or a denominational group less the percentage who would have to be shifted to other states or other groups in order to have the distribution of the group within the nation or the state conform with the national average. Most states and denominational groups have rather high g values. Only Utah, kindred Idaho, and the states of the Deep South deviate widely from the national pattern; and among the denominations, the more divergent groups are rather small in membership except for the Baptist bodies, with their powerful concentration within the South, and the strongly localized Latter-day Saints (cf. Figs. 5, 12). Four denominational groups rank exceptionally high, and thus most nearly approach a uniform and fully national distribution—the Roman Catholic, Methodist, Presbyterian, and Episcopalian (cf. Figs. 3, 6, 8, 9). The primacy of the Roman Catholics is, in good part, due to the fact that by accounting for more than 40 percent of reported church members, this group contributes greatly toward the definition of the norm from which deviations are being measured. Another factor is the choice of the areal unit; Catholics would probably score much lower and some Protestant groups much higher if g were calculated for counties or some other areal category below the state level. The wide and rather even dispersion of Episcopalians, despite their strong affinity for urban locations, is striking on the map as well

[37] Two of these more restricted groups, the Disciples of Christ and the Latter-day Saints, are missing in only three and five states, respectively.

[38] This index is defined and discussed in Harold H. McCarty, John C. Hook, and Duane S. Knos, *The Measurement of Association in Industrial Geography* (State University of Iowa, Iowa City, 1956), pp. 30–31.

TABLE 5.—COEFFICIENT OF GEOGRAPHIC ASSOCIATION (g) BETWEEN DISTRIBUTION OF MEMBERS OF DENOMINATIONAL GROUPS AND TOTAL REPORTED CHURCH MEMBERSHIP, BY STATE, CA. 1952

Denominational group	g
Roman Catholic	80.8
Presbyterian Bodies	80.1
Protestant Episcopal	78.7
Methodist Bodies	72.7
Church of the Nazarene	64.8
Adventist Bodies	64.0
Unitarian and Universalist Churches	62.9
Assemblies of God	61.6
Lutheran Bodies	61.3
Congregational Christian Church	57.5
Jewish Congregations	57.0
Churches of God	55.8
Disciples of Christ	54.9
Evangelical and Reformed Church	50.4
Friends	49.6
Baptist Bodies	48.7
Evangelical United Brethren Church	46.2
Reformed Bodies	42.2
Brethren Churches	41.3
Mennonite Bodies	40.8
Moravian Bodies	36.3
Latter-day Saints	22.0

$$g = 100 - \frac{\Sigma(m - m_s)}{2}$$

Where $m = \dfrac{\text{total, all church members in state}}{\text{total, all church members in U. S.}}$

$$m_s = \frac{\text{members of denominational group in state}}{\text{national membership of denominational group}}$$

TABLE 6.—COEFFICIENT OF SIMILARITY (g) BETWEEN INCIDENCE OF REPORTED MEMBERS, OF DENOMINATIONAL GROUPS IN EACH STATE AND FOR THE UNITED STATES, CA. 1952

State	g	State	g
1. Colorado	87.2	26. Minnesota	66.2
2. Ohio	85.0	27. South Dakota	65.7
3. Illinois	84.6	28. Vermont	65.3
4. Maryland	82.6	29. Wisconsin	65.1
5. Washington	81.3	30. Iowa	63.6
6. District of Columbia	80.7	31. Nevada	63.5
7. Missouri	80.5	32. Massachusetts	60.5
8. Michigan	78.8	33. North Dakota	60.1
9. California	78.8	34. New Hampshire	60.0
10. Pennsylvania	78.5	35. Rhode Island	58.4
11. Montana	76.4	36. Delaware	58.1
12. Wyoming	75.8	37. West Virginia	57.2
13. Arizona	75.0	38. Oklahoma	48.1
14. Texas	74.4	39. Virginia	47.9
15. Oregon	72.4	40. Florida	47.9
16. Indiana	71.0	41. North Carolina	46.0
17. Louisiana	70.8	42. Idaho	43.8
18. New Mexico	70.7	43. South Carolina	43.5
19. New Jersey	70.1	44. Arkansas	42.8
20. Kansas	70.0	45. Tennessee	42.4
21. Nebraska	69.5	46. Alabama	41.7
22. Kentucky	67.9	47. Georgia	40.8
23. Maine	67.3	48. Mississippi	37.9
24. New York	67.2	49. Utah	10.7
25. Connecticut	66.2		

$$g = 100 - \frac{\Sigma(m - m_s)}{2}$$

Where $m = \dfrac{\text{national membership of denominational group}}{\text{total, all church members in U. S.}}$

$$m_s = \frac{\text{members of denominational group in state}}{\text{total, all church members in state}}$$

as in Table 5; and Presbyterians are even more uniformly distributed, relative to both urban and rural population, than the Episcopalians.

Neither the simple distributional map (Fig. 6) nor any known statistical index can, however, do justice to the extraordinary position of Methodism in the United States. Although far outnumbered by both Roman Catholics and Baptists and not quite as evenly distributed as the Presbyterians or Episcopalians, the Methodists more closely approach the status of a "national" denomination in a geographical and statistical sense than any other group. This fact is brought out in Figure 25 which shows those counties in which Methodists represent a plurality of reported church membership, those in which they are outnumbered only by Roman Catholics, and those in which they are the second largest Protestant group. Although Methodism is dominant in a smaller area than is claimed by either the Baptists or the Catholics (cf. Figs. 5, 3),[39] the total area in which it ranks first, second, or third among the 22 denominational groups is much larger and is, indeed, well over 50 percent of the national territory. In fact, the only areas of conspicuous Methodist weakness are southern New England, east-central North Carolina, a portion of eastern Kentucky, and scattered sections of the Rocky Mountain states.

[39] A series of manuscript maps was prepared in the course of this study showing the ranking of the leading denominational groups by counties. Only the Methodist map displayed sufficient divergence from the patterns discernible in the maps of absolute membership to merit reproduction.

The distribution of each of the groups covered in this study could be readily analyzed and explained if we had adequate statistical data on the six demographic processes governing their growth: births, deaths, in-migration, out-migration, conversion (including church mergers), and apostasy (including the division of religious bodies). Unfortunately, we have very little reliable information on the fertility and mortality of the various denominations or the number of their converts or apostates. We do have an abundance of material concerning the organizational history of American churches; but since nearly all the mergers and divisions took place within the boundaries of our denominational groups, little of this information is relevant to our purpose. We must, then, rely heavily on such information as we have on the migration of church members—most of it quite indirect—along with some general facts about the human geography of the United States and items drawn from general observation in our attempt to explain the larger aspects of the present-day areal patterns of the denominational groups. Many of the minor distributional details can be easily dismissed by pointing out the existence of certain seminaries, denominational schools, hospitals, homes for the aged, publishing firms, or military camps. Such special nuclei of church members are particularly conspicuous on the maps of smaller denominations, such as the Adventists or Friends, but can occasionally be invoked even for the larger groups.[40]

Jewish Patterns

The traditional division of the American population into members of three major faiths, Roman Catholic, Jewish, and Protestant, provides a convenient approach to a discussion of the geography of the leading denominational groups. The least numerous of the three and the one whose areal pattern is easiest to describe and explain, by virtue of its recency and extreme urban character, is the Jewish group (Fig. 4). Adherents of Judaism formed an infinitesimal fraction of the American population until the 1840's when a sizeable contingent of German Jews appeared on the scene, and it was not until the 1880's that substantial Jewish immigration, originating largely in Eastern Europe, gave the United States a large non-Christian minority. Jewish immigration has continued, but at a greatly reduced scale, since the general slackening of movement to the United States in the early 1920's.[41] Most of the Jewish newcomers chose to reside in the major ports of entry and the other leading metropolises of the Northeast, pre-eminently New York City, but also Philadelphia, Boston, Baltimore, Chicago, Detroit, Pittsburgh, and Cleveland. As Table 4 and Figure 2 indicate, the Jewish group comprises a large proportion of the total church membership reported for these larger cities (no less than 33.1 percent in the New York–Northeastern New Jersey metropolitan area), and so could, incidentally, play a pivotal role in those elections or other policy decisions in which Catholic and Protestant blocs are nearly evenly balanced.

There would seem to be a strong positive correlation between size of metropolis and percentage of Jews among total church membership, so that the great bulk of the American Jewish community is confined to a relatively few places. Still there are small, but significant Jewish groups in most of the lesser cities of the nation. In the smallest of these, Jewish economic activity is largely restricted to retail sales; but in the medium-sized city Jews are attracted to certain wholesale, petty manufacturing, and professional opportunities, in addition to retailing. In fact, there is an interesting correspondence, outside the primary concentration in the urban Northeast, between the importance of a city as a wholesaling center and the size of its Jewish population. There are, of course, major departures from such a pattern of crude economic determinism. The rather larger than expected size of the Jewish groups in Savannah, Charleston, and Norfolk may, in good part, be attributed to the stability and early start of Sephardic (i.e., Iberian Jewish) settlement in those cities. Jewish migrants have followed national trends in moving to Washington, D. C., Florida, and, in especially large numbers, to the Pacific Coast cities.

[40] For example, the unexpectedly large Catholic group in Onslow County, North Carolina, is explained by the presence there of Camp Lejeune.

[41] Our immigration and census statistics, which classify arrivals by nation of origin rather than by cultural group or religion, make it difficult to estimate the religious composition of immigrant groups except in the roughest terms.

There has been the predictable outward surge to the suburban counties of the larger metropolitan areas; and the amenities would appear to play a greater role in Jewish internal migration than is observed among gentile groups in view of the unusually strong Jewish representation in the Catskill counties, Atlantic City, the larger Florida communities, and such Western centers as Denver, Tucson, and Phoenix.

Roman Catholic Patterns

The historical geography of American Catholicism has been a great deal more complex. Before the annexation of the Louisiana Territory and the acquisition of a substantial French-speaking Catholic population in southern Louisiana, Catholics had been conspicuous by their general rarity in the American population. The great influx of Irish and German Catholic immigrants that began arriving in the 1830's was predominantly urban in destination, the Irish almost wholly so. But many German and Swiss Catholics elected to settle in rural tracts, particularly in the lower Ohio Valley, the eastern Ozarks, the Texas prairies, and various sections of Michigan, Wisconsin, and Minnesota. Except for the movement to Texas, both the earlier and later Catholic immigration tended to shun the Southern states, as did most other immigrant groups. In the latter decades of the Nineteenth Century and the first quarter of the Twentieth, the Irish and German streams were reinforced by substantial Catholic immigration from Italy, Poland, Lithuania, Hungary, Croatia, Austria, Czechoslovakia, Portugal, and French Canada and lesser contributions from such areas as Great Britain, the Low Countries, and the Philippines. Currently, the trickle of incoming European Catholics is probably exceeded by entrants from Puerto Rico and French Canada and those crossing the Mexican border legally or otherwise to add their numbers to the descendants of the substantial Spanish-American population acquired by annexation in 1845, 1848, and 1853. Most of the more recent European Catholic immigrants settled in cities; but significant numbers also gravitated to the agricultural frontiers of the northern Great Plains or to various small mining settlements.

As has been the case with all immigrant communities, the initial areal patterns of Catholic settlement have been considerably modified by later internal migration. The great majority of the numerous Catholic church members on the Pacific Coast or those in peninsular Florida can be traced to sources in the Eastern and Central states rather than to direct European origins; and it is likely that most of the small, scattered Catholic groups in the Southeast are derived from points in the Northeast. It is also quite plausible, even in the absence of direct evidence, that the Catholic population of many of the larger cities of the Northeast and Middle West has been bolstered by in-migration from rural areas. Nevertheless, even though the details of Catholic distribution may have been greatly modified through the years and the total number of communicants has increased enormously, the basic pattern, established as early as 1860,[42] has remained remarkably stable for the past century.

The relative numbers of Catholics and non-Catholics have been plotted by county in Figure 1; and since Jews form only a small portion of the non-Catholic population and are numerically significant in only a few counties, the non-Catholic church membership may be interpreted for general purposes as aggregate Protestant membership. Because of the inclusion of baptized infants as members of the Roman Catholic Church and the generally more restrictive criteria of membership and frequent under-enumeration of members among many Protestant groups, this map significantly overstates the relative size of Catholic membership and understates Protestant strength. Using the results of the March, 1957 *Current Population Reports* sample survey as a guide to the actual number of professed Catholics and Protestants in the United States, the probable percentages of Catholics and non-Catholics have been indicated parenthetically in the map legend. In spite of the obvious weakness of the assumption that Protestant church membership is uniformly understated throughout the nation, the parenthetical figures probably approach the truth more closely than those derived directly from the National Council of Churches' data.

A study of Figures 1, 2, and 3 discloses the existence of several distinct regions in which Roman Catholics either predominate or form a strong minority of total church membership. Perhaps the most impressive aspect of the geo-

[42] Paullin, *op. cit.*, Plate 85.

graphy of American Catholics is the fact that they form the largest group in fourteen of our sixteen largest metropolitan areas (Washington and Minneapolis–St. Paul are the two exceptions), with more members than either the Protestant or Jewish faiths, and that they are predominant in many of the lesser as well as the larger cities of the Northeast. Thus although Roman Catholics constitute only a very large minority of the American population as a whole (40.1 percent of total church membership according to *Churches and Church Membership in the United States*, or 26.7 percent according to *Current Population Reports*), they form a substantially larger, even dominant part of the population of the highly urbanized, industrialized, and economically advanced Northeastern states (69.1 percent of total reported church membership in New England, 50.8 percent in the Middle Atlantic States, and 45.2 percent in the East North Central States[43]) which can, in turn, be considered as the "heartland" of Anglo-America.

The great Catholic concentration in the Northeast can be divided into three major sub-regions. First and most decidedly Catholic, by virtue of the convergence of several strong streams of immigration from Catholic sources, is the New England sub-region. The early, powerful Irish movement was followed by large numbers of French-Canadians, Italians, Poles, and other Eastern Europeans, with Portuguese immigrants appearing in noticeable numbers in some localities. This Catholic population is, of course, primarily urban; but there has been significant penetration of the villages and countryside, and only eastern Maine retains something of its original Protestant exclusiveness. Even greater in terms of absolute numbers is the sub-region taking in the huge coastal metropolises from New York southwest to Baltimore—and now, by recent extension, Washington—and reaching inland to include northeastern Pennsylvania, nearly all of upstate New York, western Pennsylvania, northern Ohio, and southeastern Michigan. Southeastern and central Pennsylvania (exclusive of Philadelphia) is the only large Protestant island interrupting the continuity of this area. Catholicism is relatively weak in Indiana and western Michigan, but a third large sub-region commences on the western shores of Lake Michigan to include northern Illinois, much of Wisconsin, and major portions of Minnesota and Iowa. Certain lesser concentrations lying on the outskirts of this primary region date back to the early years of settlement. Thus the remarkably persistent Catholic population of Charles and St. Marys counties, Maryland bears witness to the initial character of the colony; the sizeable communities in Marion and Nelson counties, Kentucky may be related to the fact that Bardstown was the first suffragan see west of the Appalachians;[44] the clusters of Roman Catholics in Cincinnati and at points further down the Ohio and in east-central Missouri largely originated with pioneer settlement.

Quite distinct in origin is the French Catholic region of southern Louisiana, which extends in considerably attenuated form eastward as far as Mobile Bay. The only other significant Catholic concentration in the South is the predominantly Mexican community in the lower Rio Grande Valley and other sections of southern Texas. This region adjoins and overlaps a portion of central Texas in which Catholics of German extraction are a prominent demographic element. The south Texas area might be considered a fragment of a larger Mexican Catholic region which reaches its greatest development in the upper Rio Grande Valley and other portions of New Mexico, south-central Colorado, and southern Arizona. The major Catholic agglomeration located in the southern two-thirds of California contains only a moderate number of persons of Mexican descent and is principally the result of the recent massive migration from the eastern portions of the United States. Except for a few immigrant communities of farmers and miners in Idaho, Montana, and North Dakota, the relative strength of Catholicism is not impressive in the northwestern quadrant of the nation.

There are two extensive portions of the United States in which Catholics are rarely found: the South, and the Mormon region of Utah and adjacent states. Aside from French Louisiana, those portions of Texas with sizeable Mexican or German communities, the moderately large Catholic population of pen-

[43] Or 45.1 percent of the population of the Census "Northeast," i.e., New England and the Middle Atlantic States, according to *Current Population Reports*.

[44] Latourette, *op. cit.*, p. 233.

insular Florida, the Catholic areas of Kentucky and Maryland noted above, and some of the larger commercial and manufacturing cities, Catholics are quite scarce in the overwhelmingly Protestant South. The Mormon hegemony over a vast section of the Intermontane section of the West has meant feeble representation for almost all non-Mormon groups, whether Catholic, Protestant, or Jewish. It is also important to note that there are many basically rural tracts in the southern Middle West and, as already stated, in central and southeastern Pennsylvania where Catholics form an inconspicuous minority.

The British Colonial Denominational Groups

Very nearly two-thirds (66.4 percent) of the reported Protestant church membership of the United States is accounted for by six denominational groups, the Protestant Episcopal, Quaker, Congregational, Presbyterian, Methodist, and Baptist, which have in common a British Colonial origin but are otherwise quite divergent in their history and geography. A considerable proportion of the pre-Revolutionary immigrants in the United States were Congregationalists and Friends from the British Isles, approximately 31 and 9 percent, respectively, if the Paullin tally of congregations in 1775–76 can be applied to the composition of the immigrant group. But at the present time these two groups, which ranked first and fifth among the church groups of 1775–76, have dropped to seventh and nineteenth place among the Protestant denominational groups. There is evidence to indicate that the Friends had already spent most of their initial missionary fervor by the end of the Seventeenth Century, well before the crest of their migrational movement to America and that they attracted few converts in the United States. Indeed, the current small size of the group indicates not only a feeble missionary program but also the strong probability that many persons born into Quaker families have left the faith, possibly because this form of worship may not be particularly congenial to the American ethos, and have joined other churches or are unchurched. There are now only three significant clusters of Quakers outside the original nucleus of settlement in southeastern Pennsylvania: that in the North Carolina Piedmont, the community in central Indiana and neighboring portions of Ohio and Illinois, and the much smaller group scattered through southeastern Iowa (Fig. 23). It may be assumed that all three represent colonies derived from southeastern Pennsylvania.

The colonial nucleus of Congregationalism in New England persists as the major center for adherents of this creed; but despite a general unaggressiveness in winning converts similar to that observed among the Friends, the Congregationalists were much more successful in maintaining their numbers and in extending, through migration from New England, the area in which they are a significant population element (Fig. 11). The only major exception to the strong westward thrust responsible for widespread Congregational representation in the northern third of the United States is the movement to the North Carolina Piedmont. The relative weakness of Congregationalism west of the Appalachians, as compared to the Methodist, Baptist, or Presbyterian showing, may well be attributed to the "Plan of Union" in effect among the Presbyterians and Congregationalists during much of the critical period of settlement. This rather informal agreement on a division of labor was effective in preventing Presbyterian inroads in New England, but it worked greatly to the disadvantage of Congregationalists in the winning of frontier areas.[45]

The Episcopalians, who were apparently outnumbered by the Congregationalists in colonial times, have been able to overtake them both quantitatively and areally (Fig. 9). After a period during and just after the American Revolution when the Episcopal Church underwent serious difficulties because of the suspicion of pro-British leanings, it managed to recover much of its importance and extend its membership over the entire territory of the United States. But even now the major grouping of Episcopalians lies within the only region where they figure importantly in the rural population, the primary area of colonial concentration from Connecticut southward to Virginia. From this original cluster we can trace a significant migrational stream to western New York and the northern Middle West. There has not been much deliberate missionary work (except among the Indians of the

[45] Latourette, *op. cit.*, pp. 203–214; Sperry, *op. cit.*, pp. 112–113.

northern Great Plains[46]); but the contemporary distribution and composition of the Episcopalian population cannot be accounted for by natural increase and migration alone. It appears that, partly for reasons of prestige and social status, a significant number of persons of middle and upper class position and urban residence throughout the country have gravitated to the Protestant Episcopal Church. This fact is particularly striking if membership statistics for certain suburban counties, which are distinctly upper-income in character, are compared with other counties within the same metropolitan areas.[47] We have, then, a distributional pattern much of which can be accounted for more readily by referring to current socioeconomic factors than by the historical geography of the denomination.

The Presbyterians, who migrated to the United States in considerable numbers both before and after the American Revolution, have not only augmented their ranks through natural increase but have also succeeded in attracting large numbers of converts, particularly during their westward progress across the continent.[48] Once again, the primary initial cluster lingers on as the major modern concentration: the "staging area" in western Pennsylvania and New York and eastern Ohio from which Presbyterians thrust vigorously westward and southward (Fig. 8). There is no particular pattern in the distribution of this group outside this area of maximum strength and a secondary concentration in the Carolina Piedmont, which might well be anticipated from a study of early routes of settlement; Presbyterians form a strong minority almost everywhere, and occasionally account for a plurality of church membership—except in New England.

Only a small number of Methodists and Baptists migrated to America during or after the colonial period. The spectacular success of these two leading Protestant denominations is almost wholly a matter of the conversion of the unchurched and members of other denominations by zealous bands of preachers who began fanning out into almost all portions of the nation around 1800. Church historians advance the highly plausible thesis that both the theology and polity of these churches were unusually well adapted to the social conditions of the frontier and other recently settled districts.[49] We have already noted the nearly universal prevalence of Methodists as a prominent religious minority and, frequently, as the largest single group. What remains unexplained is their particularly heavy concentration in a wide band reaching westward from New Jersey, Delaware, and Maryland across the southern Middle West to the foot of the Rocky Mountains (Fig. 6). It may be assumed that this east-west belt is simply an extension of the colonial beachhead of Methodism in the Middle Atlantic region; but since the genesis of this early cluster has not yet been accounted for, the problem remains open.

One of the most provocative questions confronting the student of American cultural geography is the close affinity between Baptism and Southern culture during the past several decades (Fig. 5). The areal distribution of members of Baptist bodies in the Southern states so closely mimics that of aggregate population that it is disconcerting to encounter the occasional gaps, such as those in the Kentucky Bluegrass or a group of counties in Appalachian Virginia or eastern North Carolina. Nonetheless, this powerful dominance of Baptism within the South is evidently rather recent in origin. If we can trust the earlier census enumerations, Baptist congregations were less numerous than those of Methodist affiliation in Southern states as late as 1860; and it was only in 1890 that the current pattern plainly emerges. The great multitude of Bap-

[46] For a map of Indian missions in the United States, see James S. Dennis, Harlan P. Beach, and Charles H. Fahs, eds., *World Atlas of Christian Missions* (Student Volunteer Movement for Foreign Missions, New York), 1911, Plate 18.

[47] Actually there is no solid proof for the notion that persons who have risen on the social ladder have deserted other denominations for the Protestant Episcopal Church. It is simply part of the folklore of American sociology. On the other hand, it is hardly credible that the numerous well-to-do Episcopalians populating the better residential sections of the nation should all be lineal descendants of members of the colonial Church of England or of more recent Anglican immigrants. For a concise survey of what is known of the sociology of religion in the United States, see Bogue, *op. cit.*

[48] Thereby cancelling, in good part, the rather close identification between Presbyterianism and a Scotch-Irish origin that was valid during an earlier period.

[49] For a concise and illuminating statement of church history on the American frontier, see Latourette, *op. cit.*, pp. 175–223.

tist members in the South tends to obscure the fact that Baptism is one of the most widely disseminated creeds in the United States. Its adherents form a significant minority and even occasionally a plurality of total church membership in most non-Southern regions. An example of particular interest is the New England concentration dating from the Eighteenth Century.[50]

The Immigrant European Church Groups

The migrational factor readily accounts for the principal distributional features of those Protestant denominational groups considered here which can be traced to the European continent.[51] Among these groups—predominantly German, Dutch, Swiss, and Scandinavian in derivation—religion has remained strongly identified with ethnic origin. Relatively few converts have been made among Americans born into other churches, certainly far fewer than the number of persons who have drifted away from the traditional faith. A glance at the maps reveals the fact that these denominations tend to be more localized than most of the British Colonial or native American churches and that their chief strength lies within the Middle Atlantic and Middle Western states (Figs. 7, 13, 14, 16, 20, 22). Conversely, they are weak in New England (which did, however, attract many Catholic immigrants) and most of the South, an area which failed to draw many of the Nineteenth and Twentieth Century arrivals from Europe. All of these groups, or their antecedent denominations, appeared in Eighteenth Century Pennsylvania and the Dutch Reformed group even earlier in Seventeenth Century New York and adjacent sections of New Jersey. As soon as the western territories were opened to settlement, they attracted a strong flow of the church members in question, partly from the older nuclei on the Atlantic Seaboard, but in greater numbers from overseas. Thus we now have sizeable clusters—and even an occasional case of local dominance—of members of the Evangelical and Reformed, Brethren, Reformed, and Mennonite churches within western Pennsylvania, Ohio, Indiana, Illinois, Iowa, southern Michigan, and southern Wisconsin.

The largest such migration was that of members of the various Lutheran bodies who have come to be the leading group over much of the territory west of the Hudson and north of the 40th Parallel (Fig. 7). A secondary, but unusually interesting movement, beginning in the Eighteenth and apparently continuing well in to the Nineteenth Century, was that of Brethren, Moravians, Lutherans, and members of the groups that were to become the Evangelical and Reformed Church southwestward from Pennsylvania and Piedmont Maryland down the Great Valley and the upper Piedmont route to various localities in western Virginia, eastern Tennessee, and, most significantly, into central North and South Carolina (Fig. 13). The only other important entry into the South was that of Lutherans and members of the Evangelical and Reformed Church into portions of central Texas, probably directly from Europe. More recently, some members of immigrant European church groups have moved into Great Plains localities or to the Pacific Coast, notably the Lutherans who are a major element in the population of the northern Great Plains and the Pacific Northwest.

By studying and comparing the maps of all the groups thus far discussed, two broad statements can be ventured concerning their migrational behavior. Firstly, we can readily detect three stages of migration, though not equally well for each denominational group: (1) the consolidation of one or more clusters of immigrants or locally converted church members in the Atlantic Seaboard during the colonial period; (2) a streaming inland of migrants, some from the older centers near the Atlantic, others from European sources, throughout the century during which the vast trans-Appalachian regions were occupied; and (3) a re-distribution of church members after the close of settlement frontiers that followed much the same patterns as can be observed for the general population—toward the Pacific Coast and the southwestern states, toward peninsular Florida and a few other favored localities on the Gulf of Mexico, and toward the large metropolises in the Northeastern quarter of the nation. Secondly, there is also a rather clear latitudinal zonation in the west-

[50] And the Baptist contingent in neighboring New Brunswick and Nova Scotia. Cf. Clark, *op. cit.*

[51] One of the identifying features of these groups is the fact that they retained the mother tongue for church services long past the time when it was dropped as the customary household language.

ward movement of Protestant church members from the Atlantic Seaboard, so that we can define three broad east-west belts—a northern zone in which denominations of Scandinavian, North German, and New England provenience (including the Unitarian) are of particular importance; a central zone in which there is a heavy concentration of groups firmly established in the Middle Atlantic area at an early date; and a large southern zone in which Baptism prevails, apparently through both migration and conversion. These zones are most sharply defined toward their eastern termini; but even though they are blurred in the West, at least the first and third are still discernible on the Pacific Coast. It is interesting to note the persistence of patterns established by early migration. Even extensive out-migration from places initially settled by Catholics or members of non-British Protestant groups has not erased their denominational distinctiveness. Thus modern religious data may serve as tracers of early movements long after Census publications cease to offer information on the national origin of a given local population.

The Native American Denominational Groups

The religious bodies of American origin represent the culmination of a trend toward a special New World identity that is apparent in most other denominations. The Protestant groups of British origin have all been strongly Americanized, in some cases almost totally transformed, and the process has gone quite far with most of the denominations originating on the European continent, in spite of stubborn rearguard actions. Even among English-speaking Catholics and Jews, who apparently will indefinitely retain Latin and Hebrew (at least among those Jews of Orthodox persuasion) as their liturgical languages, the form and spirit of religious life depart considerably from Old World practice. In some cases the new American sects patterned themselves closely after traditional models, but in numerous instances both theology and style of devotion are quite original.

We are badly handicapped in accounting for the areal patterns in the membership of most native American denominations by two basic facts: only one (the Evangelical United Brethren) of the eight groups that have been mapped for this study can be associated with an immigrant group and so tied in with known migrational currents; and there is good reason to suspect that the under-reporting of membership is more serious among most of these groups than for American denominations in general. The relatively poor statistical situation can be attributed to the loose, uncentralized structure and frequent shifts in alliance that characterize the congregations affiliated as the Assemblies of God, Churches of God, Disciples of Christ, or Church of the Nazarene and make it impossible for the National Council of Churches to gather data on some other equally important bodies (Figs. 15, 19, 10, 18). The regionalization of the Evangelical United Brethren, a body formed in 1946 by the union of two essentially Teutonic groups of Eighteenth Century Pennsylvania origin and Methodist affinity, follows the familiar pattern already observed for immigrant groups with an initial base in Pennsylvania.[52] There is the marked clustering in southeastern Pennsylvania and the adjacent segment of Maryland, an important, evidently derivative belt to the westward in the lower Middle West, and a scattering further west in the Great Plains and along the West Coast (Fig. 14).

We are on fairly solid ground in interpreting the distribution of two other groups, the Unitarian and Universalist and the Latter-day Saints. The former pair are strongly rooted in New England, the Unitarians as a late Eighteenth Century offshoot of Congregationalism and the Universalists as a group whose philosophy can be traced to European sources but who found New England during the early 1800's their most congenial rallying ground. Although the map clearly indicates the persistent dominance of the natal area, Unitarianism and Universalism now reach into all sections of the land (Fig. 21). The pattern is, in some ways, quite reminiscent of the Episcopalian, for the Unitarians and Universalists are strongly urban in residence, middle and upper class in social orientation, and rather indifferent toward missionary activity. There is one interesting difference, however. Unitarianism seems to have a particular appeal for well-

[52] The Brethren, or German Baptist, bodies might also have been classified as native American, since the current polity is so strongly American in character and origin; but their Old World connections were strong enough to confer immigrant status on the group.

educated persons of a certain libertarian and philosophical bent; and it is not surprising to find a membership symbol wherever a major university community appears on the map.

The Mormons are unique in theology, geographical implications, and the close attention they have received from the historian.[53] The historical facts are familiar enough so as not to call for recapitulation. For the geographer, the salient points concerning Mormonism are its spectacular achievements, after many early vicissitudes in the Middle West: the penetration of the Great Basin region during the 1840's well in advance of regular settlement, the development of workable methods for utilizing arid lands, the attraction of considerable members of overseas proselytes to the "Land of Zion" during the initial years in Utah, and the subsequent success in missionary work and re-settlement elsewhere in the United States and in other countries. The advantages of an early start and particularly effective ecclesiastical and economic organization are reflected in the unique degree of dominance the Mormons have gained in their stronghold within Utah, southern Idaho, and portions of other Western states (Fig. 12). A second substantial Mormon group, presumably containing both converts and migrants from Utah, is found along the Pacific Coast, with special strength in the Central Valley and the Los Angeles Basin. There are also numerous groups of Latter-day Saints in the eastern half of the nation, and particularly the Middle West, who may be explained, in part, by the persistence of early splinter groups or by the missionary efforts of the principal denomination operating out from Salt Lake City. In addition, there is a steady migration of Mormons eastward from Utah and in other directions[54] that has been generated by high fertility[55] and the limitations of the local economy.

The remaining native American denominational groups have several elements in common, aside from a tendency toward local autonomy. The Churches of God, Assemblies of God, Disciples of Christ, and Church of the Nazarene may be described as pentecostal, holiness, or evangelical groups that tend to be decidedly fundamentalist and "enthusiastic" and to lay particular stress on individual salvation through a strong personal relation with the Deity. The Adventist bodies stand somewhat aside by virtue of their rather distinctive theology. The Adventist and Mormon movements originated almost simultaneously in the same aptly styled "Burned-over District" of western New York;[56] and, strikingly enough, both denominations are rather poorly represented today in their original habitat. Adventism is now widely distributed throughout the country in both urban and rural areas; but its strongest concentration, that along the West Coast, is unique among all our denominational groups and one for which there is no ready explanation (Fig. 17). The other groups are also widely dispersed, but each with a distinct regional emphasis. The largest and oldest is the Disciples of Christ, who first appeared in Kentucky and western Pennsylvania between 1810 and 1830 and are now most numerous in the lower Middle West and Upper South, with significant outliers in eastern North Carolina, the Pacific Northwest, and central Texas (Fig. 10). The Church of the Nazarene finds its principal strength in Ohio and Indiana, the Assemblies of God in the West South Central states, and the Churches of God in those counties in and near the Southern Appalachians (cf. Figs. 15, 18, 19). All four groups have two locational aspects in common: a strongly rural orientation[57] and a

[53] Perhaps the most objective and penetrating account in the large Mormon literature is the work of a Catholic scholar, Thomas F. O'Dea, *The Mormons* (Chicago, 1957).

[54] Some American Mormons have re-settled in Canada. The Albertan groups are discussed in D. W. Buchanan, "The Mormons in Canada," *Canadian Geographical Journal*, Vol. 2(1931), pp. 255–270.

[55] Here, for once, we can speak of differential fertility with some assurance. The vital statistics for Utah's aggregate population may be taken as a valid approximation of the Mormon situation.

[56] The remarkable religious ferment in western New York during the early 1800's has been described and analyzed in an admirable historical study, Whitney R. Cross, *The Burned-Over District; the Social and Intellectual History of Enthusiastic Religion in Western New York, 1800–1850* (Ithaca, N. Y., 1950). One of Cross' principal theses, and an idea that will bear further investigation, is the suggestion that the religious malaise and inventiveness of an area settled largely by New Englanders was basically a series of variations upon the earlier New England religious syndrome.

[57] Quite possibly, much of this strength in the larger metropolitan areas is based on recent migration from the countryside; but this is, of course, pure speculation.

negative correlation with regions in which the foreign-born are numerous. On the basis of the map data and cursory observation, these church members might be characterized as lower or lower middle-class native whites residing chiefly on farms and in small towns. The defects of our data may well conceal other significant facts, such as the possibility, suggested by travel in the region, that this group of fundamentalist bodies, along with others not included in this study, may be much more strongly represented in the upland than in the lowland sections of the South. Any attempt to explain the areal patterns of these denominations must fall back upon the facts of their place of origin, the careers of especially forceful individuals, the almost random events of church history and diplomacy, and, possibly, certain common social and cultural tendencies about which we have no information.

THE RELIGIOUS REGIONS OF THE UNITED STATES

In view of strong variations in denominational strength from place to place in the United States that are clearly evident in spite of serious shortcomings in our data, it is most desirable to hazard some delineation of religious regions. There is little doubt that any number of regional systems could be worked out on a quantitative basis which would satisfy various sets of logical, but arbitrary, statistical assumptions. Such an exercise would not, however, answer the question of whether such regions really exist or are just a figment of the geographic imagination. If we accept the inherently reasonable notion that regions truly exist within the cultural landscape when their residents are aware of their existence and find them significant in some manner, it is not too hard to demonstrate religious regions in many parts of the Old World—in the Near East or Eastern and Central Europe, for example. The case of the United States is much less simple. The Mormon realm is an admirable example of a human geographic region in which religion is the chief genetic factor as well as a reason for the persistent distinctiveness of the area; and, on a lesser scale, a good case can be made out for southeastern Pennsylvania having acquired a unique geographic personality mainly because of its large quota of "peculiar people" and other staunch church members to whom religion has been a dominant force. On a miniature scale, there are scattered about the nation a number of small colonies of pietistic church members—notably those within the Mennonite fold—who have gone to some lengths to shun the worldly ways of their neighbors and have created microregions strikingly different in form and function from the encompassing culture (Fig. 22).[58]

The special regional character of New England might also be attributed in part to its quasi-theocratic past and the unique blend of denominations housed within the area. Religion is certainly a significant element in the maintenance of cultural identity within the French- and Spanish-speaking Catholic areas; but, strictly speaking, it is subordinate to the ethnic factor, as can be seen if we consider the contrasts with the strong English-speaking Catholic populations which adjoin or overlap these groups at various points. A much less convincing argument could be advanced for the role of religion in the creation and preservation of the South as a distinct geographic region. There are no peculiarly Southern religious practices or denominational groups; and even though the particular combination of churches found within the region is not even distantly approached elsewhere, few, if any, Southerners are conscious of religion as an item setting them apart from the non-Southern population. Thus, with the possible exceptions of the areas listed above, most Americans do not regard religious affiliation as a factor making one locality markedly different from another and are, in fact, only dimly aware of areal variations in the relative strength of major denominations.

This indifference is reflected and reinforced by the relatively minor contribution of the religious life to the visible landscape of the nation. Outside the Mormon and certain of the older Spanish-American areas, the church has played a rather inconspicuous part in shaping the form and content of settlement, whether urban or rural. In New England, the church building often does dominate the village green; but elsewhere the anomalous status of religion in American life is painfully clear in the relegation of churches to sites generally

[58] A Manitoba example is examined in John Warkentin, "Mennonite Agricultural Settlements of Southern Manitoba," *Geographical Review*, Vol. 49(1959), pp. 342–368.

outside the urban core. Aside from church buildings, the only tangible evidence of spiritual concern is found in burial grounds, parochial school buildings and the quite occasional nunnery or monastery—a wholly different situation from that documented in great detail by Deffontaines for much of the Old World. Furthermore, there are some religious bodies, such as the Friends, which are assiduously invisible; and even the connoisseur of ecclesiastical architecture is often hard pressed to distinguish the churches of one Protestant denomination from those of another.[59]

Most of the seven major regions and five sub-regions shown in a general and tentative way in Figure 26 can be justified neither by rigorous statistical logic nor by any obvious manifestations in the works or non-religious ways of men, but only by a certain loose areal association among certain groupings of church members, i.e., some moderate degree of areal homogeneity apparent to the map analyst if not to the majority of inhabitants,[60] and the little we know of the configuration of the general culture areas of the United States.[61] It is not at all clear whether their particular religious composition is a genetic factor in the emergence of these general areas, whether it is one of the by-products of the larger culture, or whether there has been a more complex interplay of forces at work; but, in any event, this areal coincidence between religion and other cultural phenomena does call for further investigation into their mutual relations. It is, then, in the hope of illuminating the larger problems of the cultural regionalization of the nation that the following, quite provisional scheme is offered.

Two other prefatory comments are necessary. Although the huge Catholic population of the Northeast is recognized on the regional map by the use of a special pattern showing its principal concentrations, this population appeared too recently to have been effective in shaping the enduring cultural personalities of the Northeastern states. Consequently, regional boundaries were drawn solely upon the basis of earlier Protestant groupings. Elsewhere, in the Spanish Catholic region and the French Catholic sub-region, Catholicism was a decisive early force and is so acknowledged in locating regional boundaries. It was impossible, without making the map altogether too complex, to recognize the religious uniqueness of many of our larger cities. It is hoped that the reader will realize that such cities as New York, Miami, Detroit, or Pittsburgh do form areally minute sub-regions standing quite apart from the larger regions in which they are situated.

New England, the first of our major religious regions, is one in which Roman Catholicism is widely dominant, but its distinguishing characteristic is the strength of its Congregationalist population and, to a lesser extent, the large contingents of Unitarians, Universalists, and Episcopalians. There are substantial Jewish populations in some of the larger cities and rather more Baptists in the region than are found in most of the remainder of the American Northeast. Conspicuous by their rarity are Methodists and Presbyterians (except in northern New England) and members of the various Teutonic denominations (except for a modest number of Lutherans in southern New England).

A second, much larger region denoted as the Midland reaches westward rather irregularly from the Middle Atlantic shore to the Central Rockies. Methodism is the branch of Protestantism most strongly represented, but religious composition varies greatly from place to place. Many cities and some rural tracts are dominated by Catholics, while the Jewish

[59] This is not to deny the existence of some interesting denominational, regional, and chronological differences in American church buildings. The stylistic features of Catholic, Christian Scientist, and Jewish structures are easily recognized and widely known, as are the New England colonial, the Georgian, and the Greek Revival schools of church architecture. There are also other genres, such as the Southern rural Negro church, which, unfortunately, no architectural historican has yet undertaken to study.

[60] Figure 26 was drawn after a study of both the maps showing absolute numbers of church members (Figures 3 to 24) and the manuscript maps showing relative ranking of denominational groups.

[61] An approach to the delimitation of these areas is attempted in Glenn T. Trewartha, "Types of Rural Settlement in Colonial America," *Geographical Review*, Vol. 36(1946), pp. 568–596, Wilbur Zelinsky, "Where the South Begins: the Northern Limit of the Cis-Appalachian South in terms of Settlement Landscape," *Social Forces*, Vol. 30(1951), pp. 172–178 and "Some Problems in the Distribution of Generic Terms in the Place-Names of the Northeastern United States," *Annals*, Association of American Geographers, Vol. 45(1955), pp. 319–349, and Hans Kurath, *A Word Geography of the Eastern United States* (Ann Arbor, 1949).

element is prominent in the larger metropolises. Large numbers of Presbyterians, Baptists, Episcopalians, Disciples of Christ, and various native American and Teutonic groups appear in many localities. A major sub-region, the Pennsylvania German, can be delimited in Pennsylvania and portions of Maryland, West Virginia, and Virginia, within which churches of Teutonic provenience are clearly in the majority or form a large minority and Catholicism is inconspicuous.

The Upper Middle Western Region is one in which Lutheranism frequently shares dominance with Catholicism, but it is still recognizable as the westward extension of New England in the strong showing of Congregationalists and, in some cities, Unitarians. Large minorities of Methodists, Episcopalians, and Presbyterians are in evidence. Locally, Baptists and members of various native American and Teutonic churches may be important.

The large Southern Region is readily identified as one in which Baptists are strongly dominant and Methodists form persistently large minorities. Presbyterians and Episcopalians are also well represented, while such native American churches as the Disciples of Christ, the Church of the Nazarene, or Churches of God show some strength locally. The uniformly British and native Protestant character of most of the Southern Region is interrupted by islands of Catholics—German and Spanish-speaking in Texas, French-speaking in Louisiana, and Catholics of Northern origin in southern Florida. Each of these subregions is clearly set apart from the remainder of the South by important non-religious factors. A sub-region of peculiar interest is that located in the Carolina Piedmont, an area whose cultural distinctiveness has not been fully appreciated in the geographical literature. This sub-region is decidedly a portion of the South; but the significance of Presbyterians, Friends, Congregationalists, and various Teutonic groups suggests a divergence in general demographic, cultural, and historical development from, say, Virginia or South Carolina that even the casual student would have little trouble in detecting. The common boundary between the Southern and Midland Regions shown in Figure 26 corresponds surprisingly well with what is known about the northward extent of the more general Southern culture area, except possibly for the exclusion of part of the Kentucky Bluegrass from the South.[62] I believe it is safe to state, from personal observation and discussion, that there is a closer identification in the Southern Region betwen religious denomination on the one hand and caste and class on the other than is to be found elsewhere in the United States, although something of the same situation seems to prevail in rural and small-town society in a good many parts of the Middle West. This correlation betwen religious and social status is distinct from, though not unrelated to, the lowland-upland dichotomy already noted in the religious structure of the South.

The Mormon Region is the most easily mapped and described of all seven, for within it only negligible numbers of Catholics, Jews, or other Protestant church members appear. The almost equally distinctive Spanish Catholic Region is centered primarily in New Mexico, Arizona, and southwestern Texas, but extends northward into Colorado and overlaps the Western Region in southern California. Members of various British and native Protestant denominations, particularly the Baptist and Methodist, form sizeable minorities alongside the Catholic plurality.

The last of the regions, the Western, has the least recognizable personality. As the recipient of steady streams of migrants from all other sections of the nation, this region has substantial numbers of members in almost all the denominational groups, but is not the major center for any, with the doubtful exception of the Adventists. Neither do we find any clear patterns of dominance by any single church, if we except the Catholic situation in portions of California; but there is a tendency for the groups that are best developed in the New England and Upper Middle Western regions to be well represented in the Pacific Northwest and for the denominations that are firmly based in the Southeastern states to gravitate to central and southern California.

[62] Cf. Kurath, *op. cit.*, and Zelinsky, "Where the South Begins." The northern limits of the South tend to blur west of the Mississippi, a fact indicated in a study of a rather anomalous area in central and northeastern Missouri, Robert M. Crisler, "An Experiment in Regional Delimitation: the Little Dixie Region of Missouri," *Summaries of Doctoral Dissertations XVII (1949), Northwestern University,* pp. 352–356.

SOME CONCLUSIONS

After analyzing recent church membership data which, for all their shortcomings, constitute the best set of statistics yet to appear on the religious composition of the American population, it is possible to offer several significant, but highly general, observations on the distributional aspects of the major denominational groups:

(1) The great multiplicity of denominations in the country as a whole is matched by the heterogeneity of religious composition within smaller areas. The major exceptions are to be found in the Mormon Region and much of the South.

(2) As a corollary to (1), we must note that while no two denominational groups have strongly similar distributional patterns and each does have one or more major regional concentrations, most denominational groups do tend, to a striking degree, to be national in distribution.

(3) The system of religious regions and sub-regions tentatively postulated in this study contains only two or possibly three cases of regions whose religious distinctiveness is immediately apparent to the casual observer and is generally apprehended by their inhabitants. The other regions in this set are suggested on the basis of their possible correlation with general culture areas and/or on the basis of the areal association of church membership patterns of various denominational groups as observed on a rather coarse scale.

(4) There is a great deal of heterogeneity within the postulated religious regions in terms of the lesser details of the areal patterns of individual denominational groups (but, as indicated in (3), much less variability on the macroregional scale). This heterogeneity has been partially recognized in the establishment of the sub-regions. Although there are many sharp contrasts among small rural tracts, the most important contrasts are those between rural and urban patterns. These rural-urban differentials can, indeed, be said to transcend the limits of all the regions and present a national dichotomy, the understanding of which is basic not only for the study of religion and demography but for most of the phenomena of concern to the human geographer as well.

(5) It is possible to offer only partial, rudimentary interpretations of the areal patterns of the individual religious regions and the various denominational groups, mainly in terms of migrational history and, to a much lesser degree, vital trends and the processes of conversion and apostasy.

(6) It is apparent from general observations and from such scanty information as has been brought into evidence in this study that there is almost certainly some sort of areal correlation between religious adherence on the one hand and length, stability, source, and type of settlement, rural-urban residence, social class, economic status, and certain cultural and psychological characteristics on the other, both for individual denominational groups and for the religious regions. Unfortunately, we lack the information or the research techniques to state the precise nature and significance of such inter-relationships. Thus it would not be prudent to search further at this time for the answers to the questions that have motivated this study: What kinds of religious regions and how many exist in the United States; how did they happen to originate; and how has religion interacted with other phenomena in imparting regional differences to the land and people of the nation?

The temptation to speculate on the interrelationships between religious affiliation and political, social, and economic behavior is admittedly almost irresistible; but the data are hopelessly inadequate not only for purposes of explanation but even for satisfactory basic description. In pursuing such research, it would be foolhardy to rely solely on membership data, the only sort we have or are likely to be given for some time, even assuming their completeness, accuracy, and comparability; but it may be profitable to see, in retrospect, why we have leaned as heavily as we have on such a seemingly slender reed. Each of our denominational groups—in fact almost every one of the individual religious bodies—is a haven for persons of widely differing theological, social, and cultural attitudes. There is usually a characteristic and strongly defined cluster of traits, a mode or stereotype which adequately defines much of the membership; but significant minorities of members may be strewn along the entire range of the theological or social gamut. A brief consideration of the Methodists, whom we have described as perhaps the most nearly national in distribu-

tion of all the major denominational groups, would bear out this contention, but any other group would do as well. Even the Roman Catholic Church is much less monolithic in structure and behavior than many persons believe; there are many distinct and semi-autonomous foreign-language groups within the Church, each jealously guarding its particular set of cultural characteristics, and beyond the basic religious life of the English-speaking parish there lies a great array of monastic orders, social and cultural lay groups, and educational institutions catering to a broad variety of tastes. The ascription of a common cultural and historical background to the Jewish population is possible, although an experiment fraught with hazard. In actuality, American Jewry is deeply cloven not only along the lines separating the Orthodox, Conservative, and Reformed sectors but by political, national, and class barriers as well. The heterogeneity of most of the Protestant denominations finds expression in the constant emission of new splinter groups.

What we need, then, are not only tabulations of formal adherence to a given creed but also some adequate measures of intensity of religious belief, frequency or regularity in religious observances, locus on the liberal-fundamentalist spectrum, and statistics that will enable us to relate religious behavior with social, demographic, and economic characteristics. If denominational affiliation is so poor an indicator of the religious or social identity of an individual, and hence, by implication, of a locality, why should geographers concern themselves at all with the topic? Simply because, despite a general looseness in structure and willingness to be as miscellaneous as possible which we find among most American church groups, they do have central tendencies. They are not only convenient receptacles for people of common national origin, spiritual aspiration, or socioeconomic attitudes, but they can also at least partially re-mould the personalities and actions of the persons born or adopted into the fold. It is unquestionable that individuals born within Catholic, Jewish, Mormon, Mennonite, or a number of other Protestant groups will inherit an ineradicable set of cultural differences from their families and co-religionists. Those who elect to transfer their allegiance to a faith to which they are not native but toward which they feel a strong affinity may frequently find themselves carried along faster and further than they had originally intended as they comply with the group norms. We may have trouble in detecting contrasts in the appearance, behavior, or material works of American denominations, for this is a nation in which religious feeling tends to run shallow despite the luxuriation of creeds; but the sense of religious difference —as distinct from religious feeling *per se*— is a powerful and often highly emotional element in the minds of Americans that works to bind together or separate groups of people and thus to create areal resemblances or contrasts.[63] Of central importance to geographers is this fact that religious institutions seek out, accentuate, and preserve differences among men and that differences, not only in the land but in the people who occupy it, whether they be real or imagined, are the meat and drink of geographers. Religious denominations have certainly been among the factors in the creation and perpetuation of some American cultural regions. In the case of the Mormon realm, it has been a phenomenon of overwhelming importance; and in New England and eastern Pennsylvania less decisive, but certainly significant. Elsewhere, as in the South where Baptism was apparently adopted as the creed most compatible with the genius of the region long after its personality had become clearly defined, a given blend of denominations may well have helped to crystallize a region or at least served to prevent its obliteration. From the scanty evidence available, we have reasonable grounds for proposing the hypothesis that religion is a significant element in the population geography of the United States, in the geography of a number of economic, social, and cultural phenomena, and in the genesis and persistence of general cultural regions; but we have too little knowledge of the precise ways in which religion operates in these various directions. Devising ways to collect and interpret information for testing this hypothesis may prove to be one of

[63] There may be a little overt difference in the behavior of most Protestants, Jews, and Catholics; but even if he is religiously indifferent, the sense of belonging to an endogamous group is a strong one for a member of any of the three major faiths, and he realizes that he may suffer serious psychological and social disabilities should he marry outside the faith.

the most difficult, but also potentially one of the most rewarding tasks awaiting the student of American cultural geography.

An adequate discussion of the more promising methods that might be tested in approaching the geography of religion in the United States would require a rather lengthy statement. In closing the present study, however, a few tentative suggestions, briefly stated, would seem to be in order. If we assume, as we regrettably must, that there is scant likelihood of any marked improvement in the quantity and quality of our religious data in the foreseeable future, the geographic investigator might gain valuable insights into the role of religion in shaping the individuality and variability of our land by pursuing any of these five, not necessarily exclusive, avenues of research: (1) Intensive local studies; (2) detailed study of the historical geography of individual denominations; (3) the statistical analysis of areal association on a national or regional scale involving such religious statistics as we have and relevant demographic, economic, and social statistics; (4) the careful search for relevant material in both the methodological and substantive writings of scholars in other fields touching on religion—theology, demography, sociology, social psychology, political science, and history (including the history of ideas, art history, and other topics beyond the more conventional limits of historical scholarship; and (5) comparative studies involving the United States, or substantial sections thereof, and other portions of the world.

The first approach would take any region of convenient size and character and subject its religious characteristics past and present to the most rigorous analysis possible. All aspects of religion of possible relevance to the geographer would be explored in depth both in the field and through the study of documents. The second method would follow much the same course as the first; and in examining a given group rather than a fixed area would scrutinize all phases of its historical geography, going beyond the national boundaries when necessary. The next approach, though beset by many statistical pitfalls occasioned by the feebleness of much of the basic information, is greatly to be commended to those who are amply supplied with both technique and caution. After the accumulation of a significant store of information through one or more of these methods, the results of research in corollary disciplines and by geographers in other nations could be exploited most fruitfully in framing a new, more nearly satisfactory statement of the geography of religion in the United States.

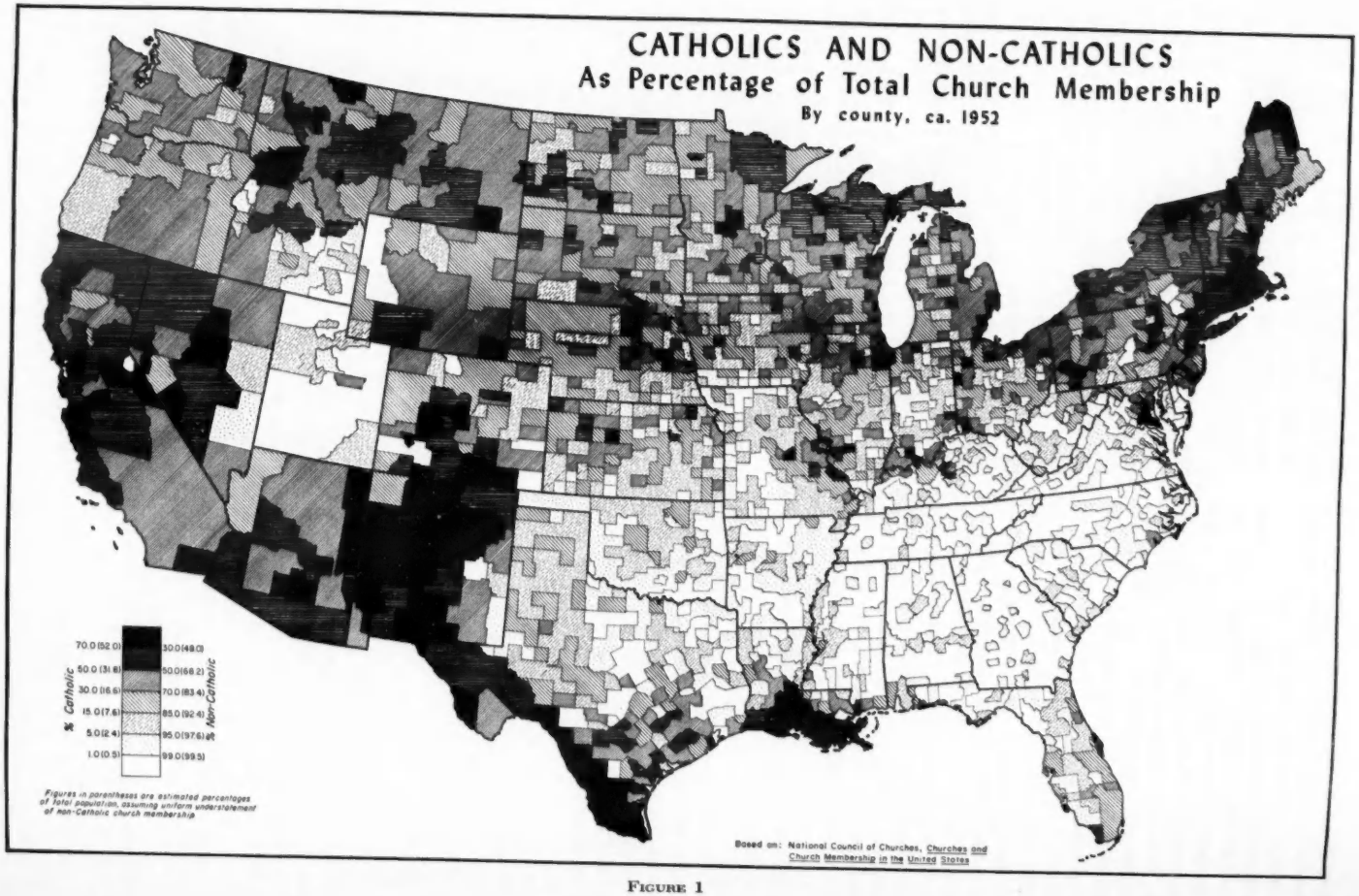
CATHOLICS AND NON-CATHOLICS
As Percentage of Total Church Membership
By county, ca. 1952
% Catholic
70.0 (52.0)
50.0 (31.8)
30.0 (16.5)
15.0 (7.6)
5.0 (2.4)
1.0 (0.5)
% Non-Catholic
30.0 (48.0)
50.0 (68.2)
70.0 (83.4)
85.0 (92.4)
95.0 (97.6)
99.0 (99.5)
Figures in parentheses are estimated percentages of total population, assuming uniform understatement of non-Catholic church membership
Based on: National Council of Churches, Churches and Church Membership in the United States

FIGURE 1

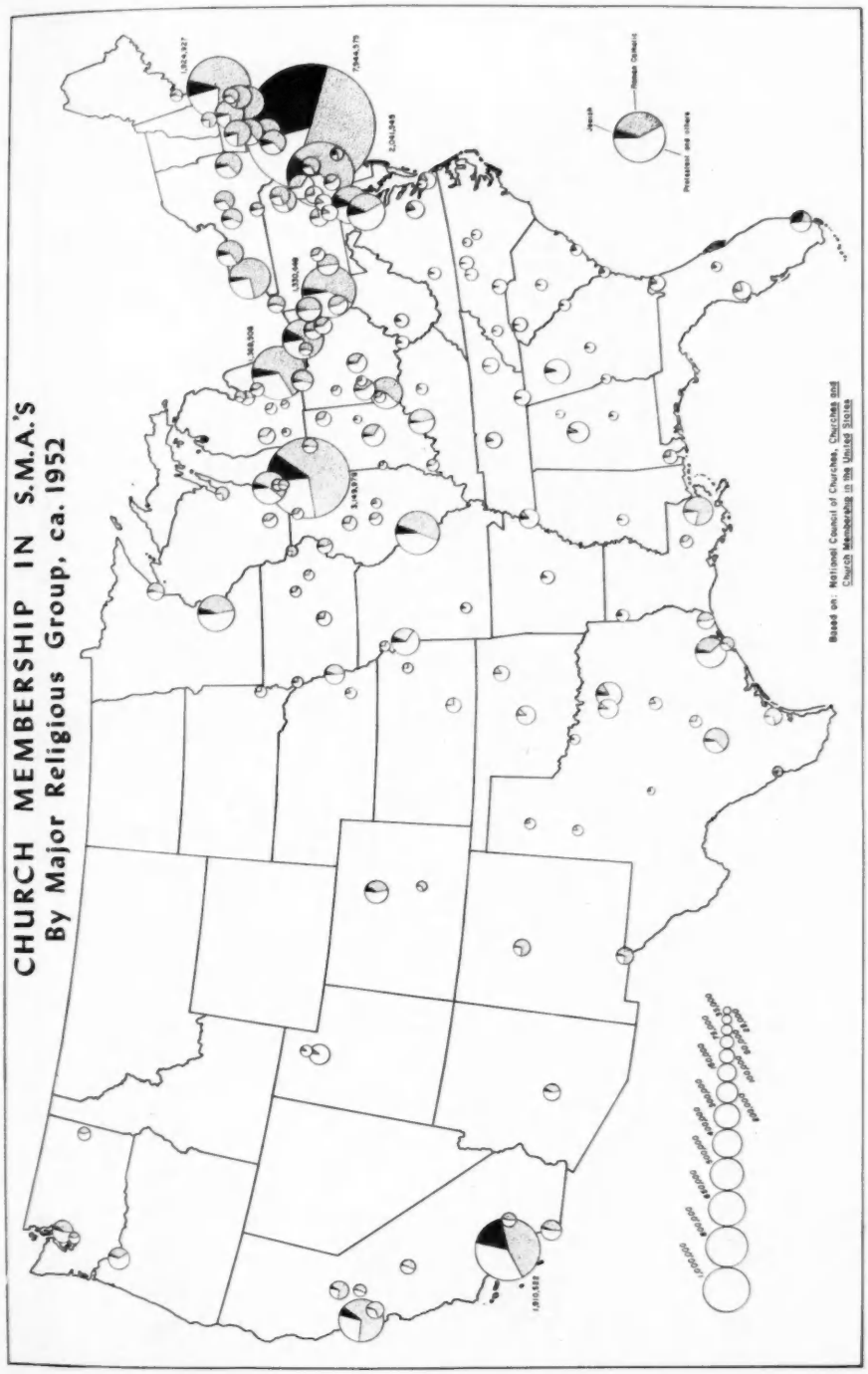
CHURCH MEMBERSHIP IN S.M.A.'S
By Major Religious Group, ca. 1952
Based on: National Council of Churches, Churches and Church Membership in the United States

FIGURE 2

FIGURE 1

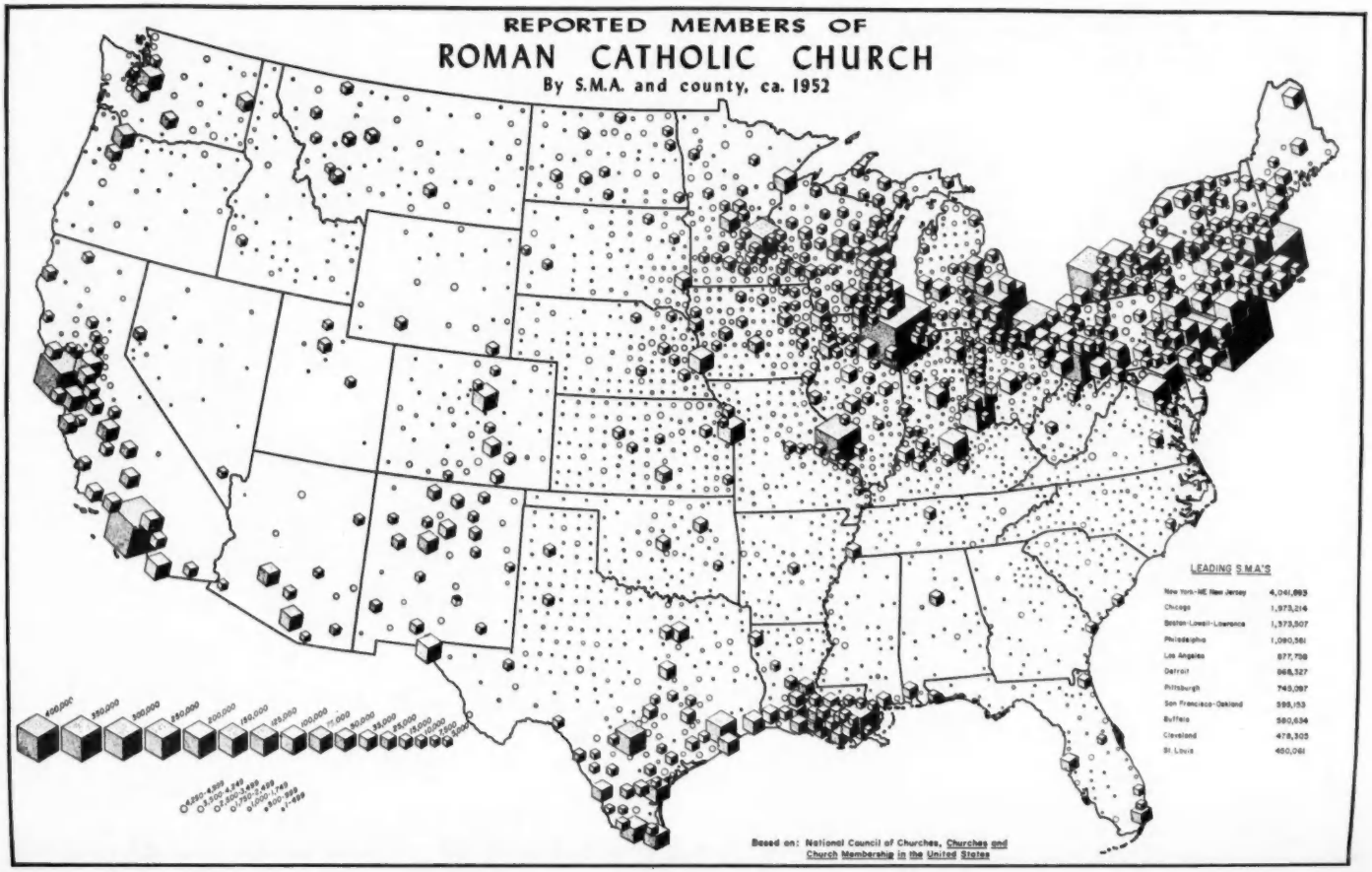
REPORTED MEMBERS OF
ROMAN CATHOLIC CHURCH
By S.M.A. and county, ca. 1952
LEADING S.M.A.'S
New York-NE New Jersey 4,041,893
Chicago 1,973,214
Boston-Lowell-Lawrence 1,373,507
Philadelphia 1,090,561
Los Angeles 877,758
Detroit 868,527
Pittsburgh 743,097
San Francisco-Oakland 595,153
Buffalo 580,634
Cleveland 478,305
St. Louis 460,061
Based on: National Council of Churches, Churches and Church Membership in the United States

FIGURE 3

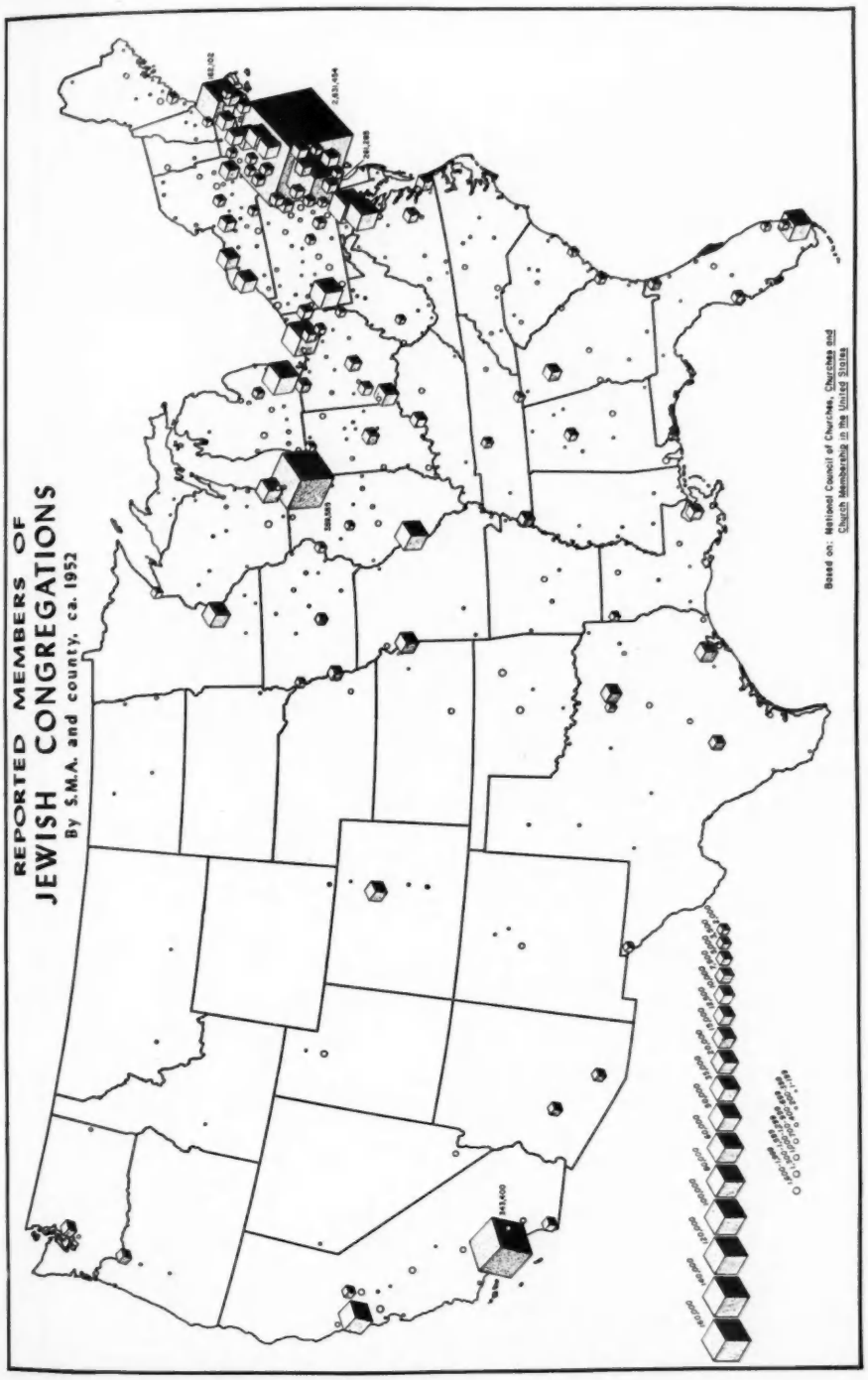
REPORTED MEMBERS OF
JEWISH CONGREGATIONS
By S.M.A. and county, ca. 1952
Based on: National Council of Churches, Churches and Church Membership in the United States

FIGURE 4

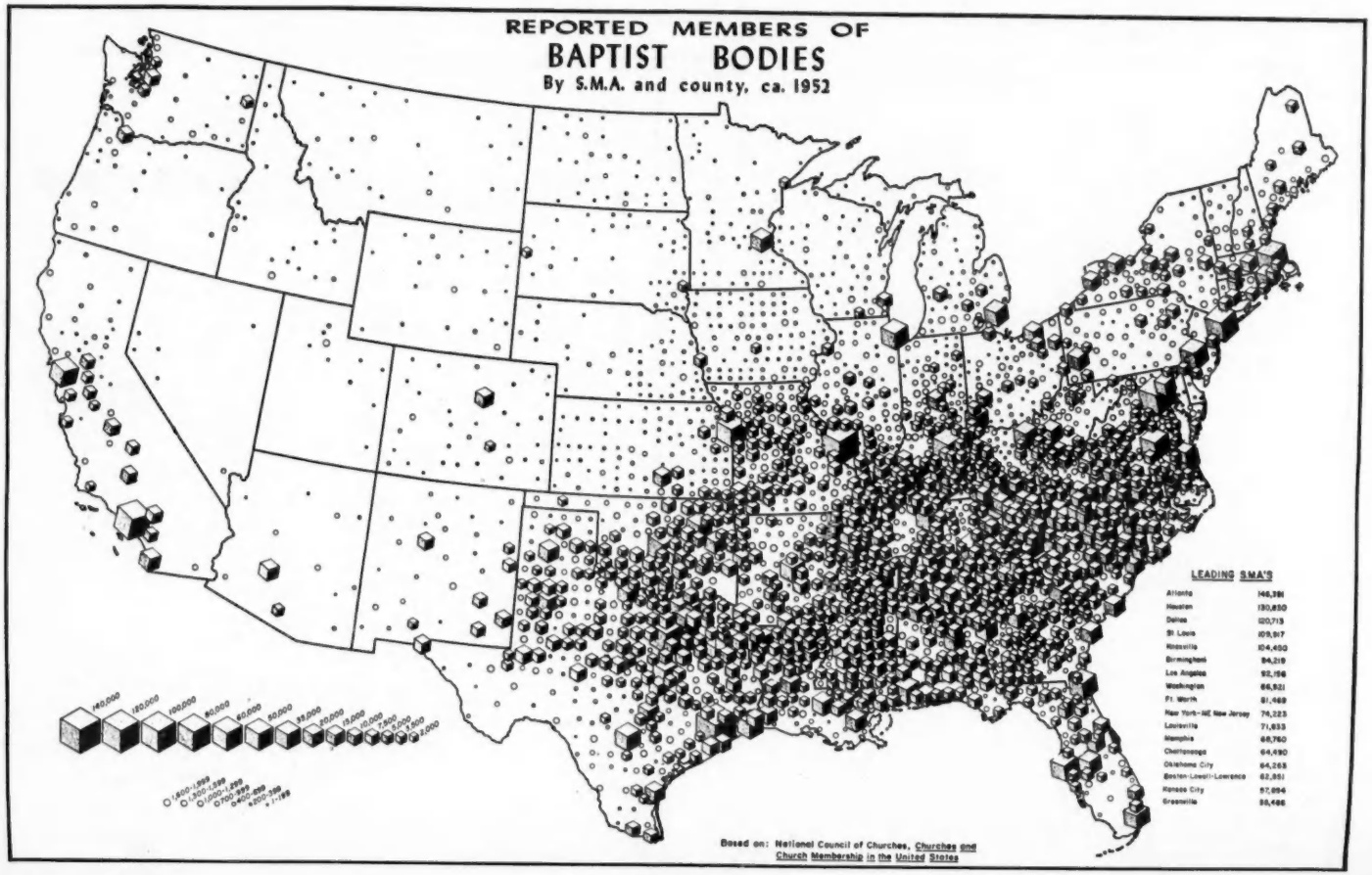
REPORTED MEMBERS OF
BAPTIST BODIES
By S.M.A. and county, ca. 1952
LEADING S.M.A.'S
Atlanta 146,281
Houston 130,830
Dallas 120,713
St Louis 109,917
Knoxville 104,450
Birmingham 94,219
Los Angeles 92,158
Washington 86,821
Ft. Worth 81,469
New York-NE New Jersey 76,223
Louisville 71,033
Memphis 68,760
Chattanooga 64,490
Oklahoma City 64,263
Boston-Lowell-Lawrence 62,351
Kansas City 57,894
Greenville 50,486
Based on: National Council of Churches, Churches and Church Membership in the United States

FIGURE 5

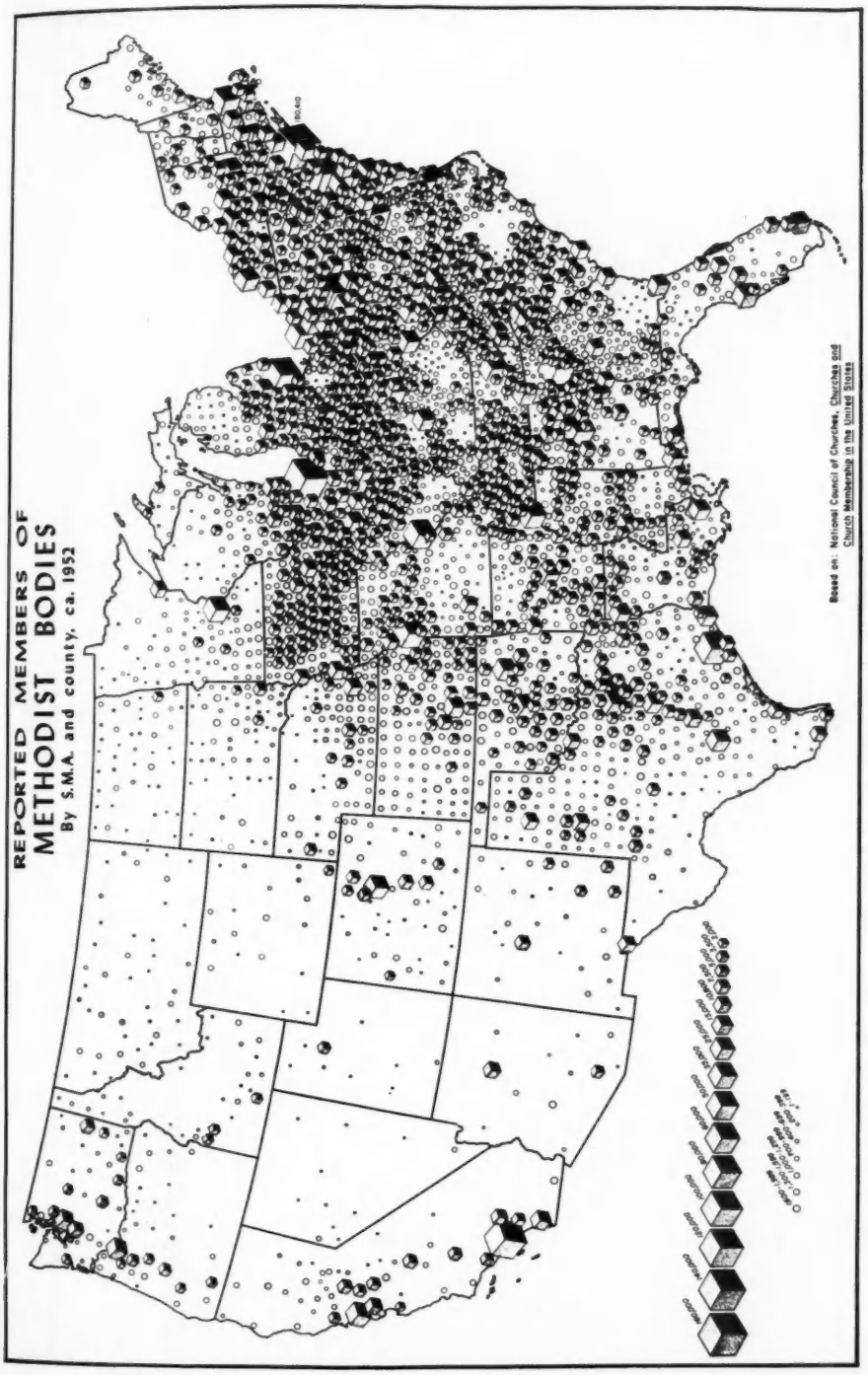
REPORTED MEMBERS OF
METHODIST BODIES
By S.M.A. and county, ca. 1952
Based on: National Council of Churches, Churches and Church Membership in the United States

FIGURE 6

REPORTED MEMBERS OF
LUTHERAN BODIES
By S.M.A. and county, ca. 1952
Based on: National Council of Churches, Churches and Church Membership in the United States

FIGURE 7

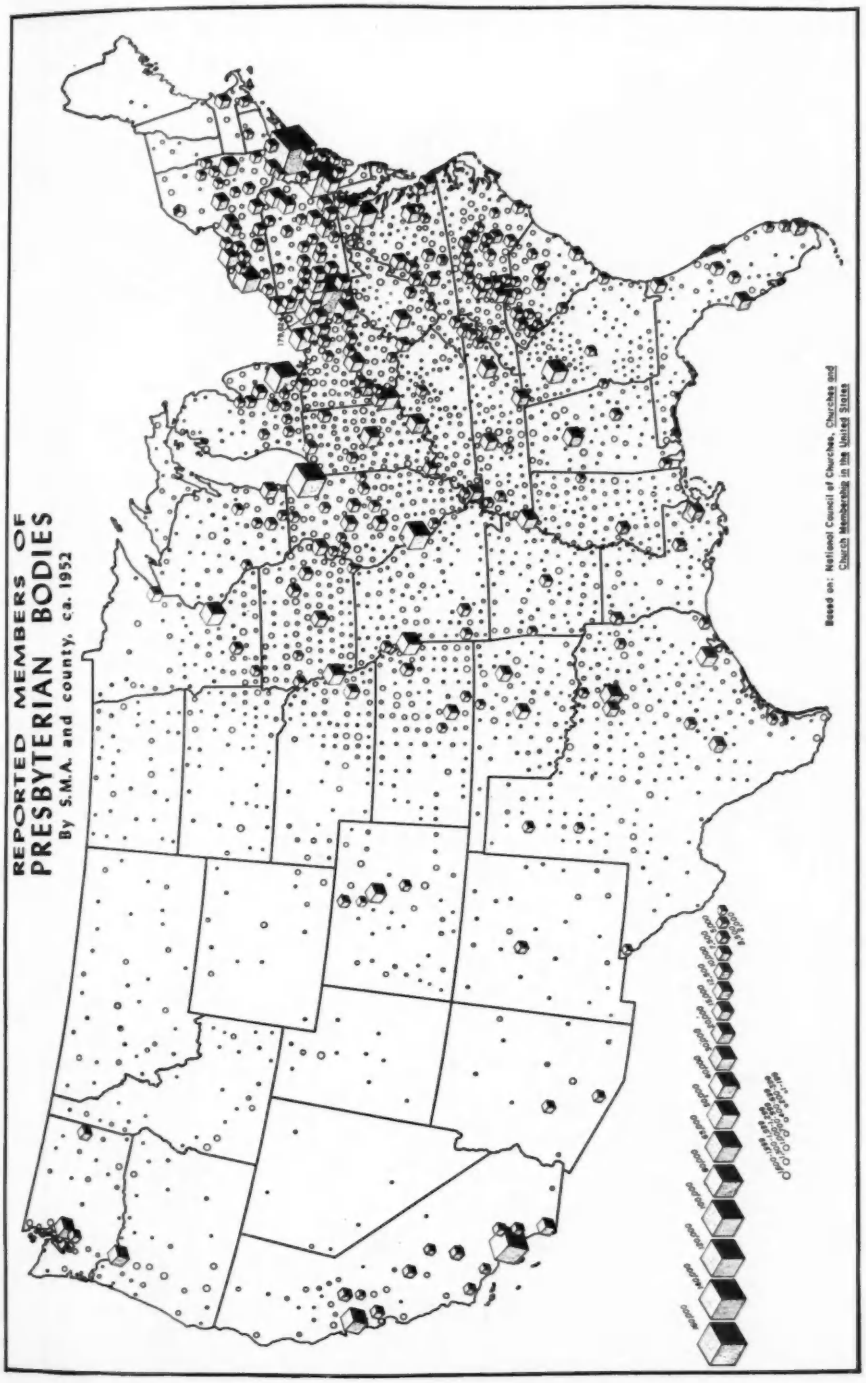
REPORTED MEMBERS OF
PRESBYTERIAN BODIES
By S.M.A. and county, ca. 1952
Based on: National Council of Churches, Churches and Church Membership in the United States

FIGURE 8

FIGURE 7

REPORTED MEMBERS OF
PROTESTANT EPISCOPAL CHURCH
By S.M.A. and county, ca. 1952
Based on: National Council of Churches, Churches and Church Membership in the United States

FIGURE 9

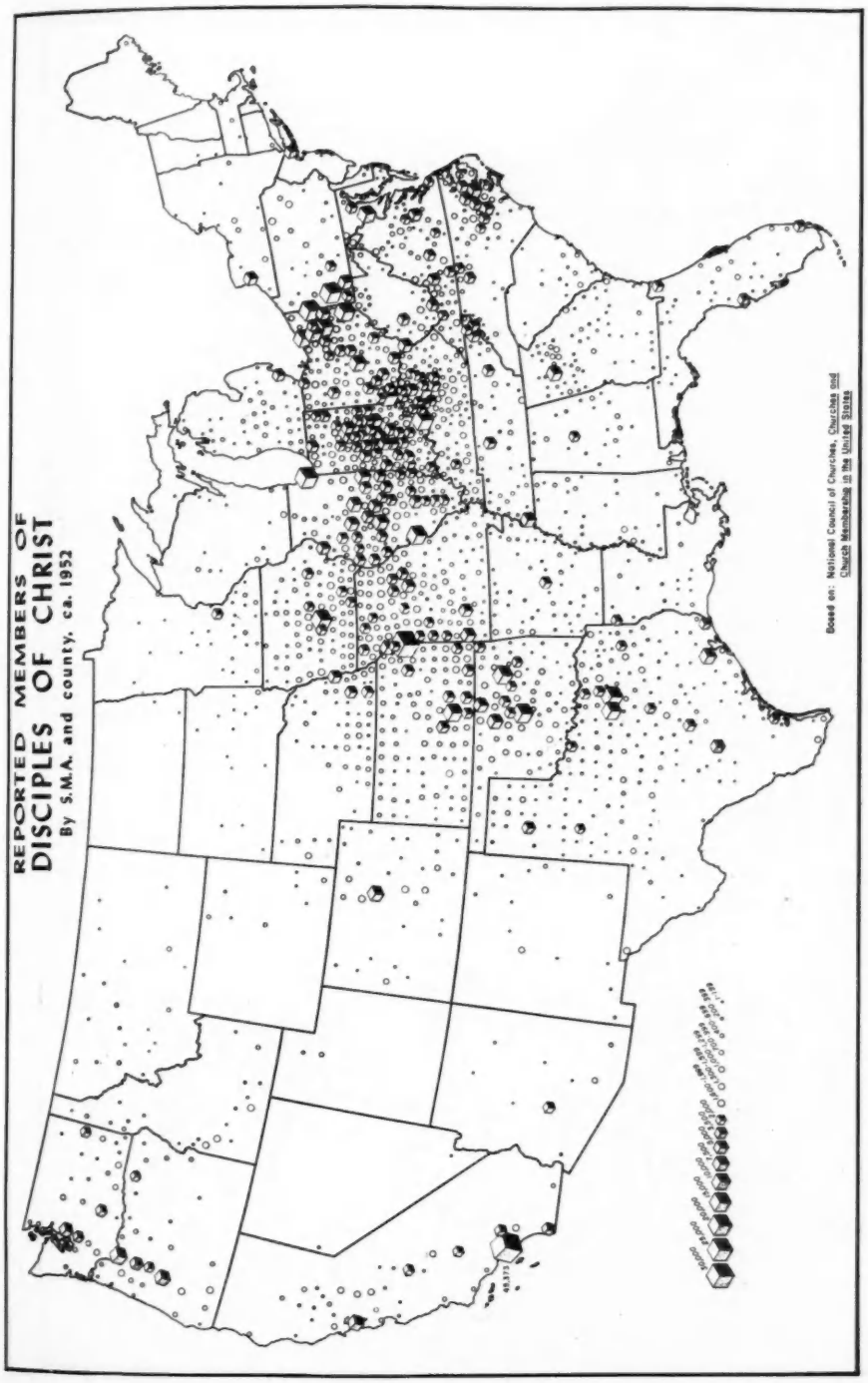
REPORTED MEMBERS OF
DISCIPLES OF CHRIST
By S.M.A. and county, ca. 1952
Based on: National Council of Churches, Churches and Church Membership in the United States

FIGURE 10

FIGURE 9

REPORTED MEMBERS OF
CONGREGATIONAL CHRISTIAN CHURCHES
By S.M.A. and county, ca. 1952
Based on: National Council of Churches, Churches and Church Membership in the United States

FIGURE 11

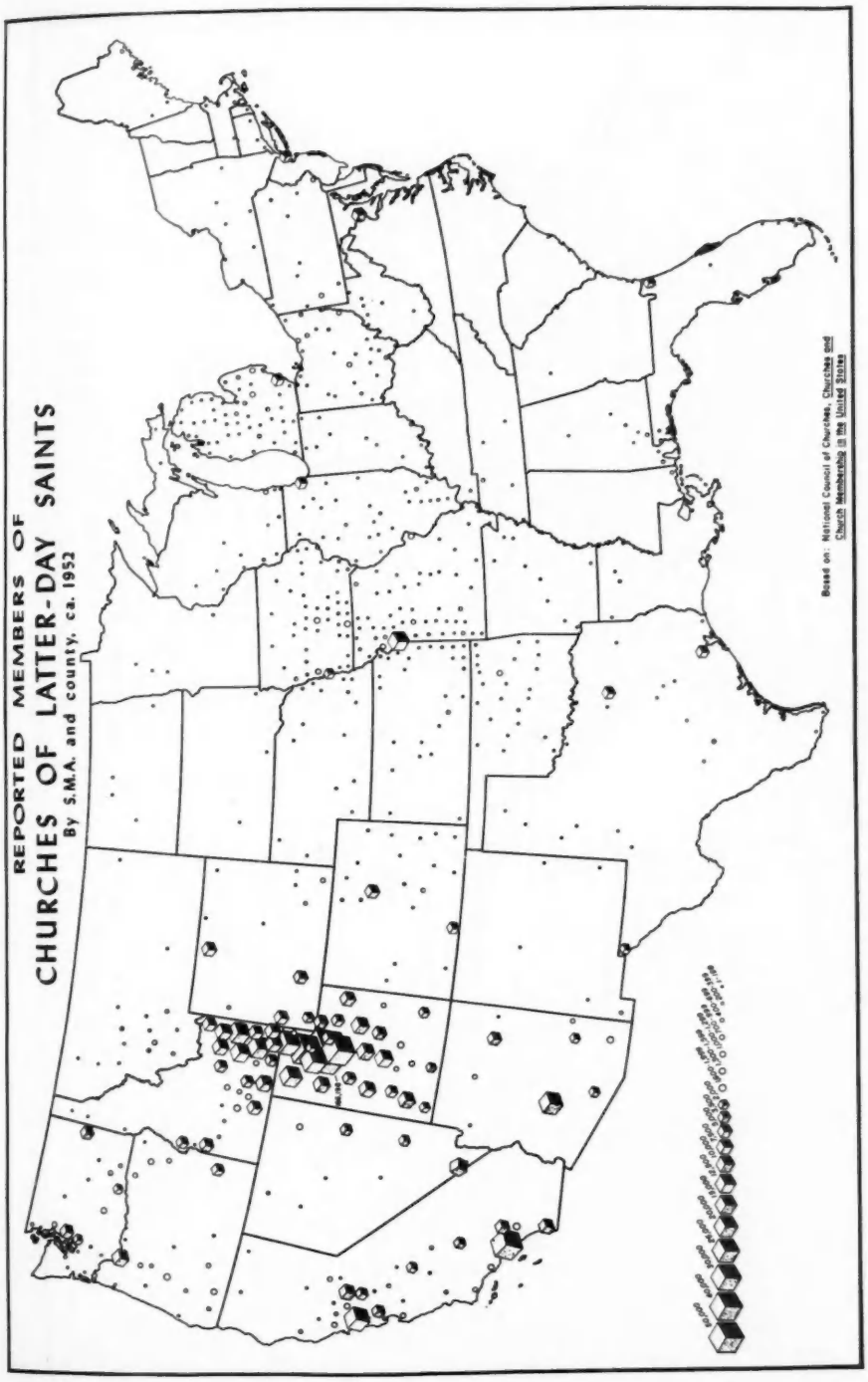
REPORTED MEMBERS OF
CHURCHES OF LATTER-DAY SAINTS
By S.M.A. and county, ca. 1952
Based on: National Council of Churches, Churches and Church Membership in the United States

FIGURE 12

FIGURE 11

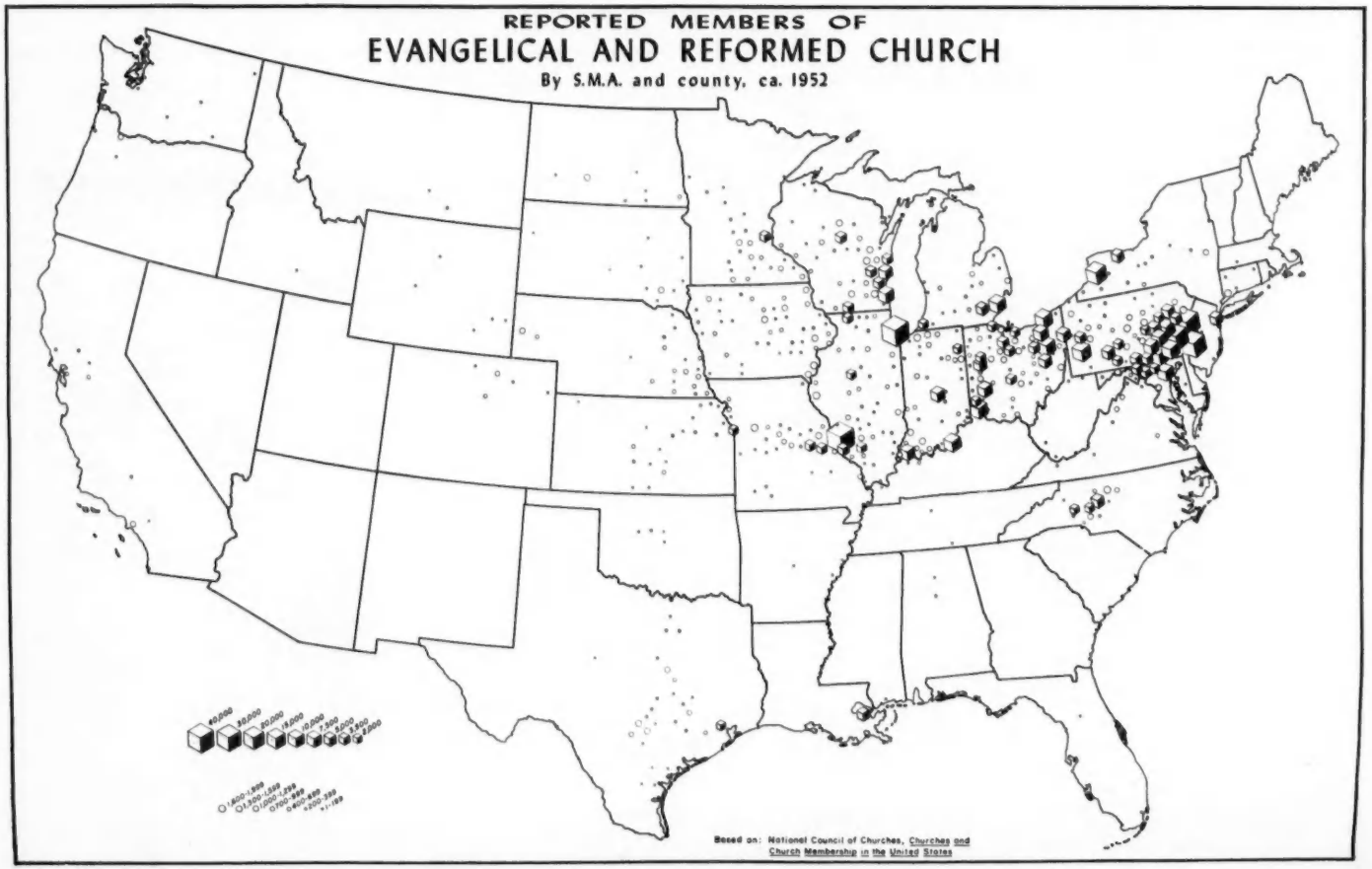
REPORTED MEMBERS OF
EVANGELICAL AND REFORMED CHURCH
By S.M.A. and county, ca. 1952
Based on: National Council of Churches, Churches and Church Membership in the United States

FIGURE 13

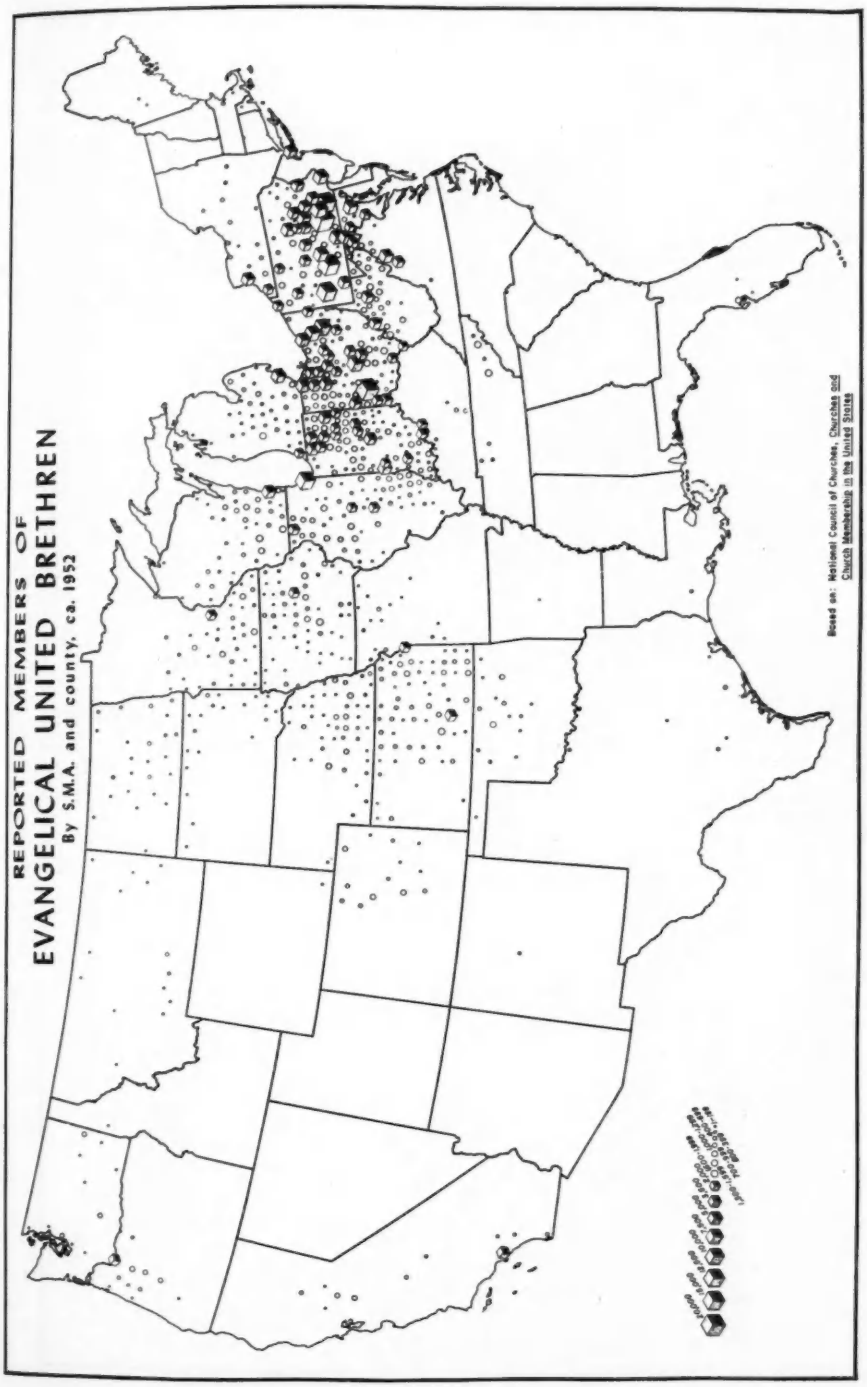
REPORTED MEMBERS OF
EVANGELICAL UNITED BRETHREN
By S.M.A. and county, ca. 1952
Based on: National Council of Churches, Churches and Church Membership in the United States

FIGURE 14

FIGURE 13

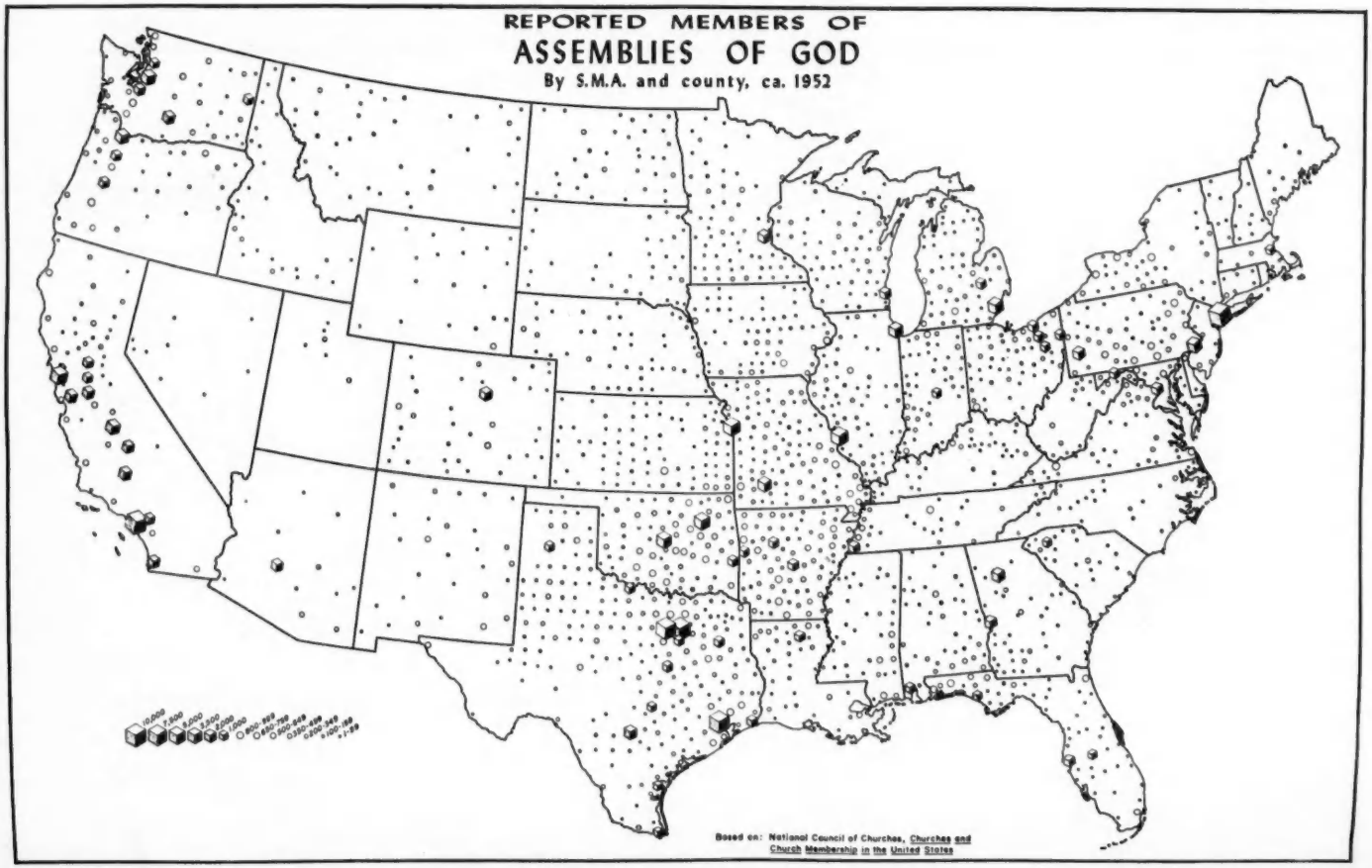
REPORTED MEMBERS OF
ASSEMBLIES OF GOD
By S.M.A. and county, ca. 1952
10,000
7,500
5,000
2,500
1,000
900-999
650-799
500-649
350-499
200-349
100-199
1-99
Based on: National Council of Churches, Churches and Church Membership in the United States

FIGURE 15

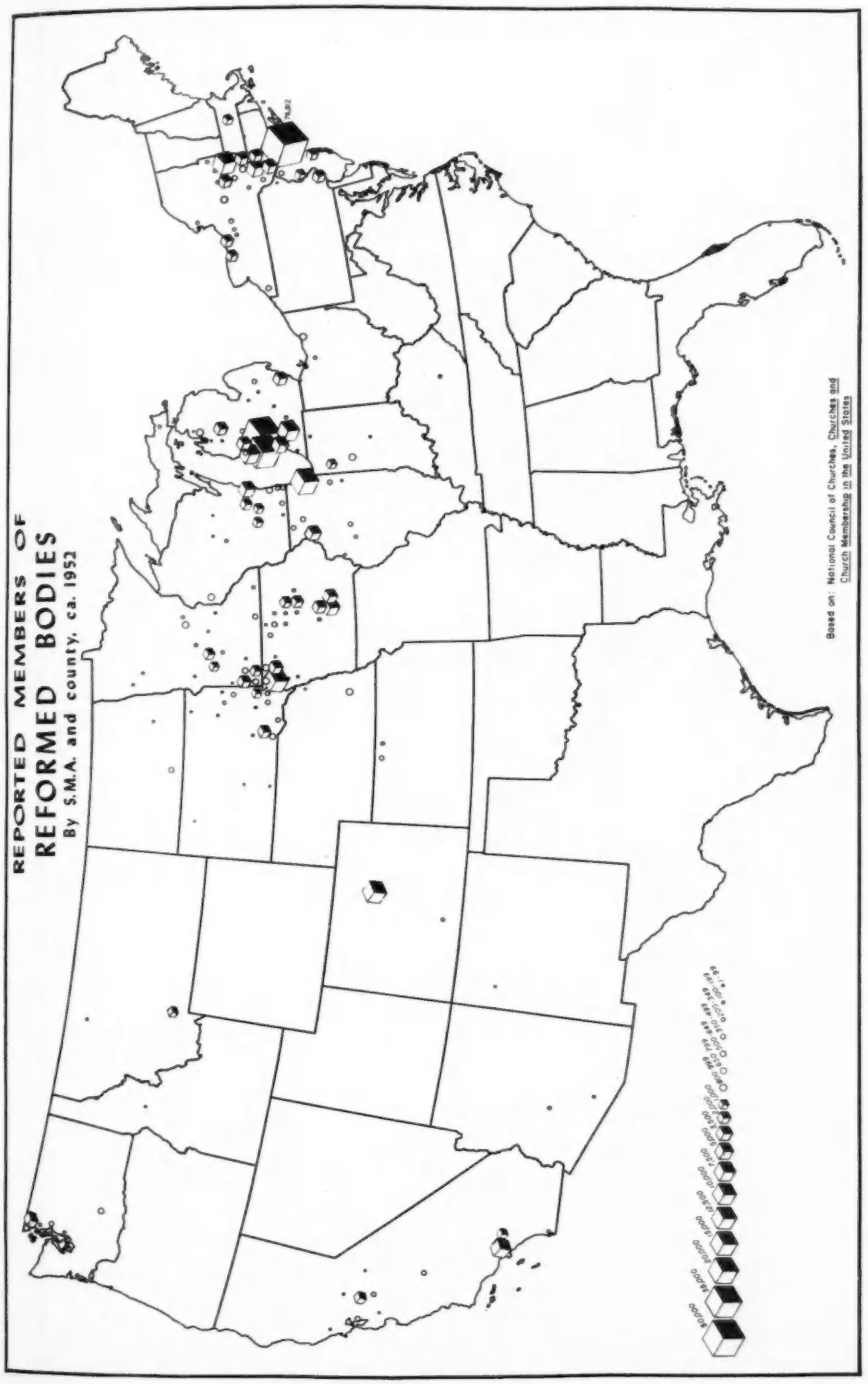
REPORTED MEMBERS OF
REFORMED BODIES
By S.M.A. and county, ca. 1952
Based on: National Council of Churches, Churches and Church Membership in the United States

FIGURE 16

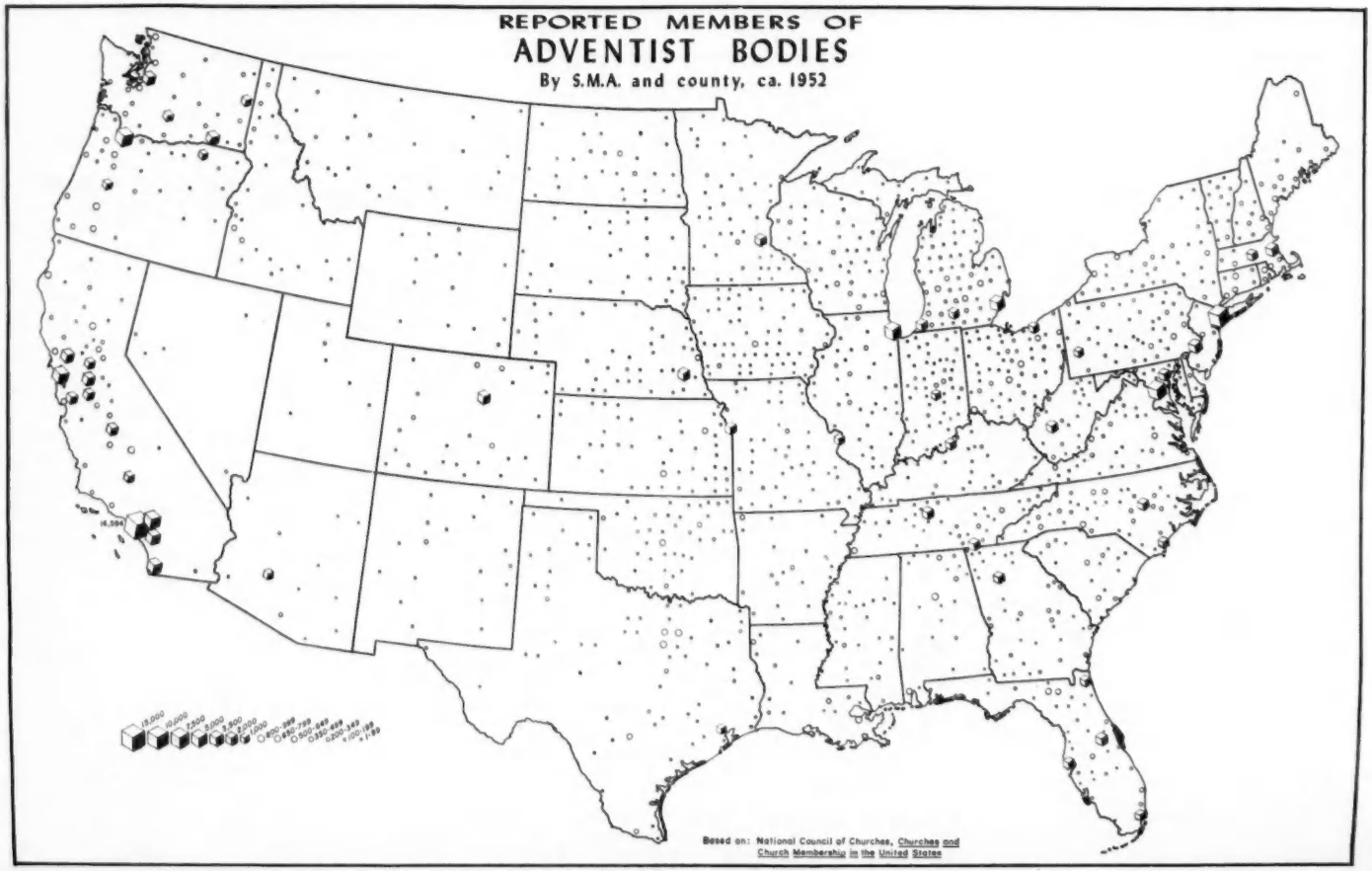
REPORTED MEMBERS OF
ADVENTIST BODIES
By S.M.A. and county, ca. 1952
Based on: National Council of Churches, Churches and Church Membership in the United States

FIGURE 17

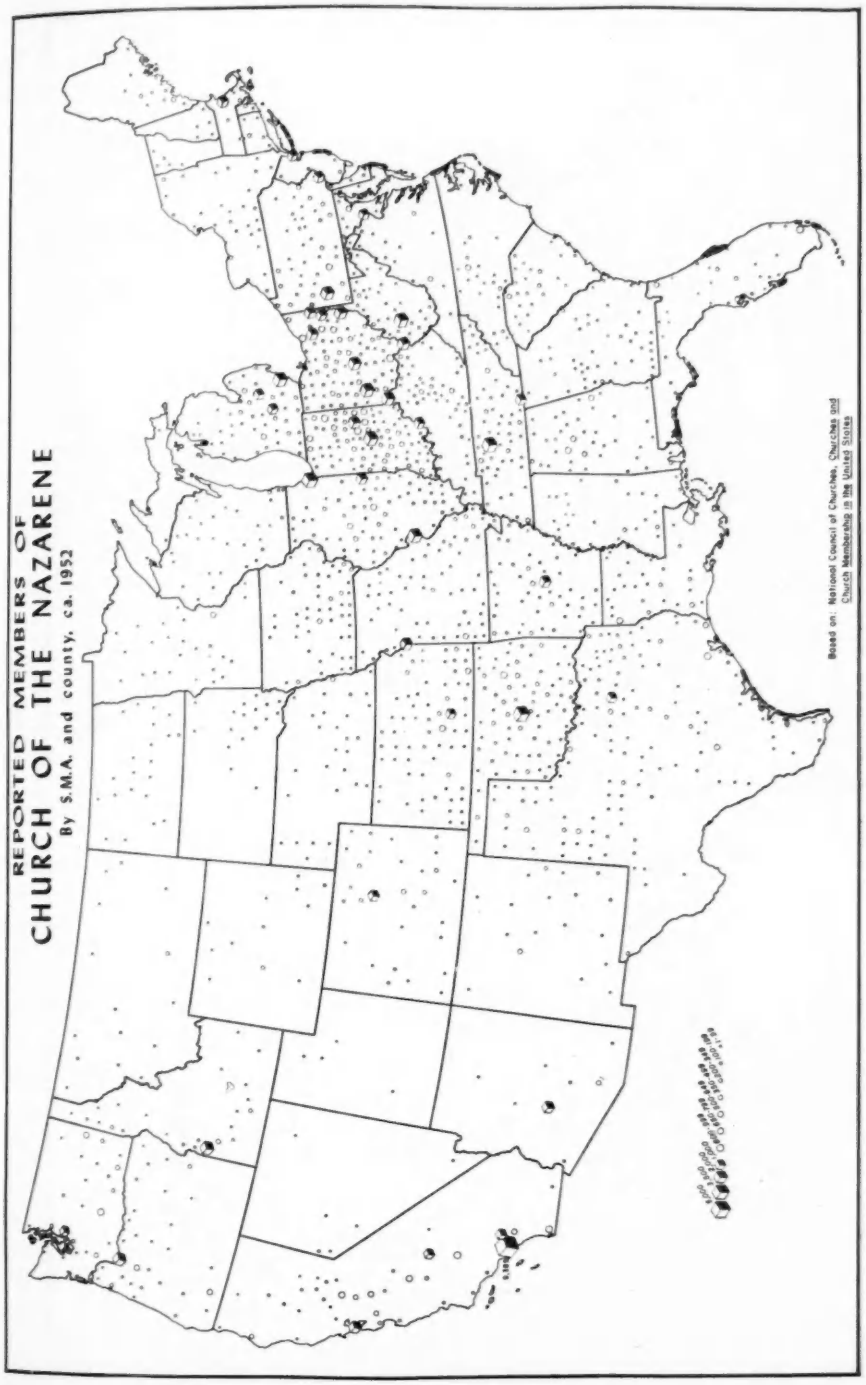
REPORTED MEMBERS OF
CHURCH OF THE NAZARENE
By S.M.A. and county, ca. 1952
Based on: National Council of Churches, Churches and Church Membership in the United States

FIGURE 18

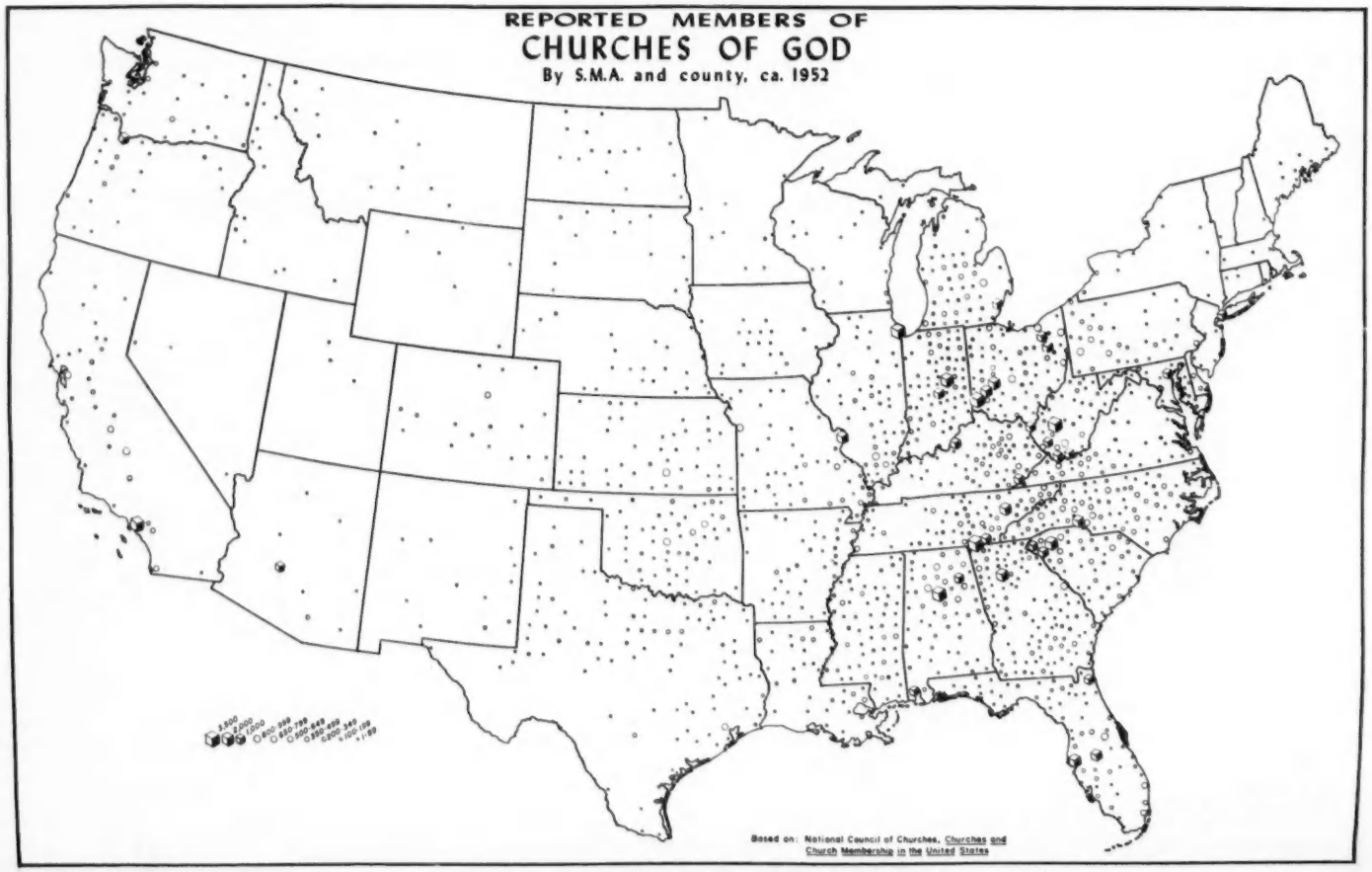
REPORTED MEMBERS OF
CHURCHES OF GOD
By S.M.A. and county, ca. 1952
Based on: National Council of Churches, Churches and Church Membership in the United States

FIGURE 19

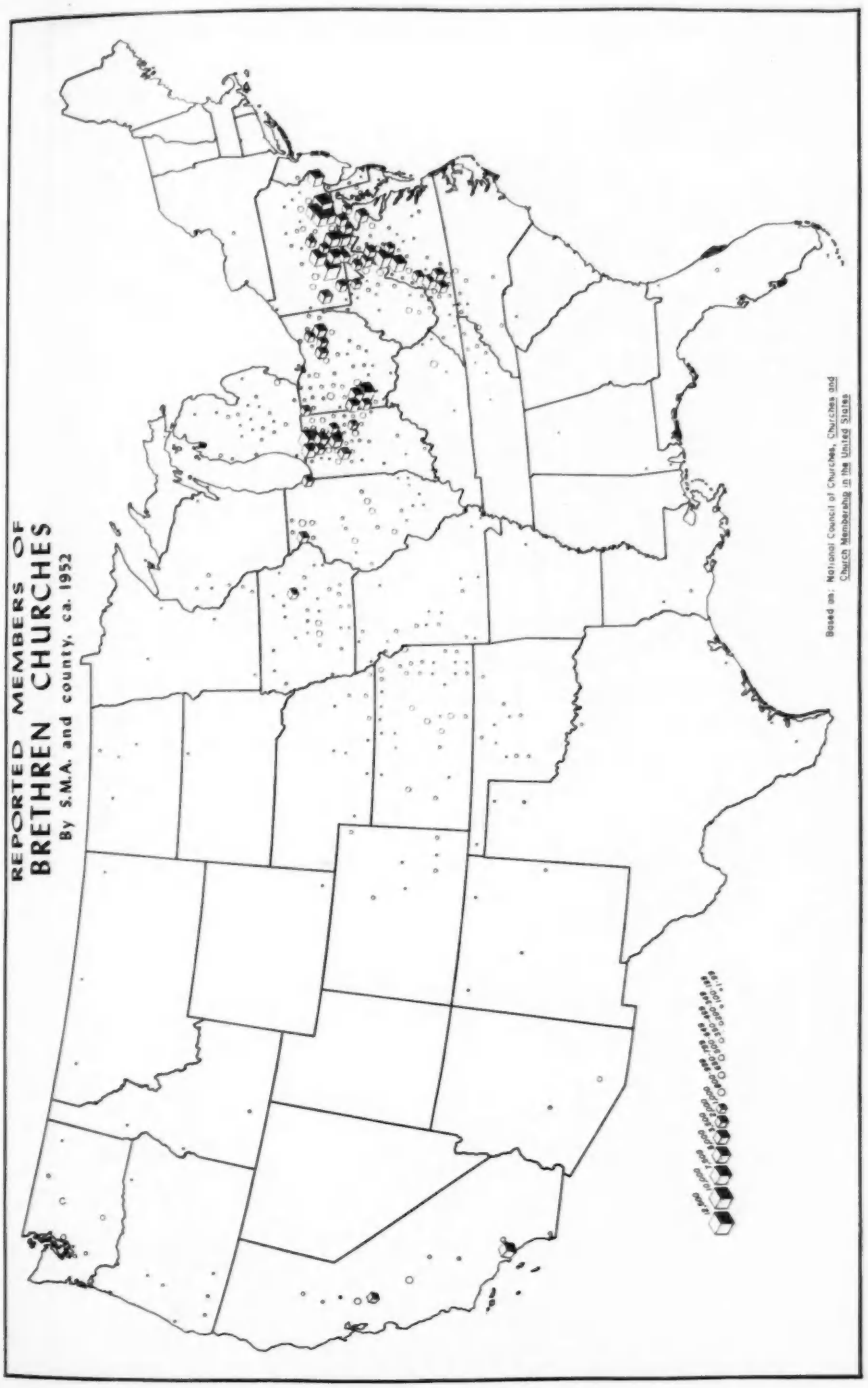
REPORTED MEMBERS OF
BRETHREN CHURCHES
By S.M.A. and county, ca. 1952
Based on: National Council of Churches, Churches and Church Membership in the United States

FIGURE 20

FIGURE 19

REPORTED MEMBERS OF
UNITARIAN AND UNIVERSALIST CHURCHES
By S.M.A. and county, ca. 1952
Based on: National Council of Churches, Churches and Church Membership in the United States

FIGURE 21

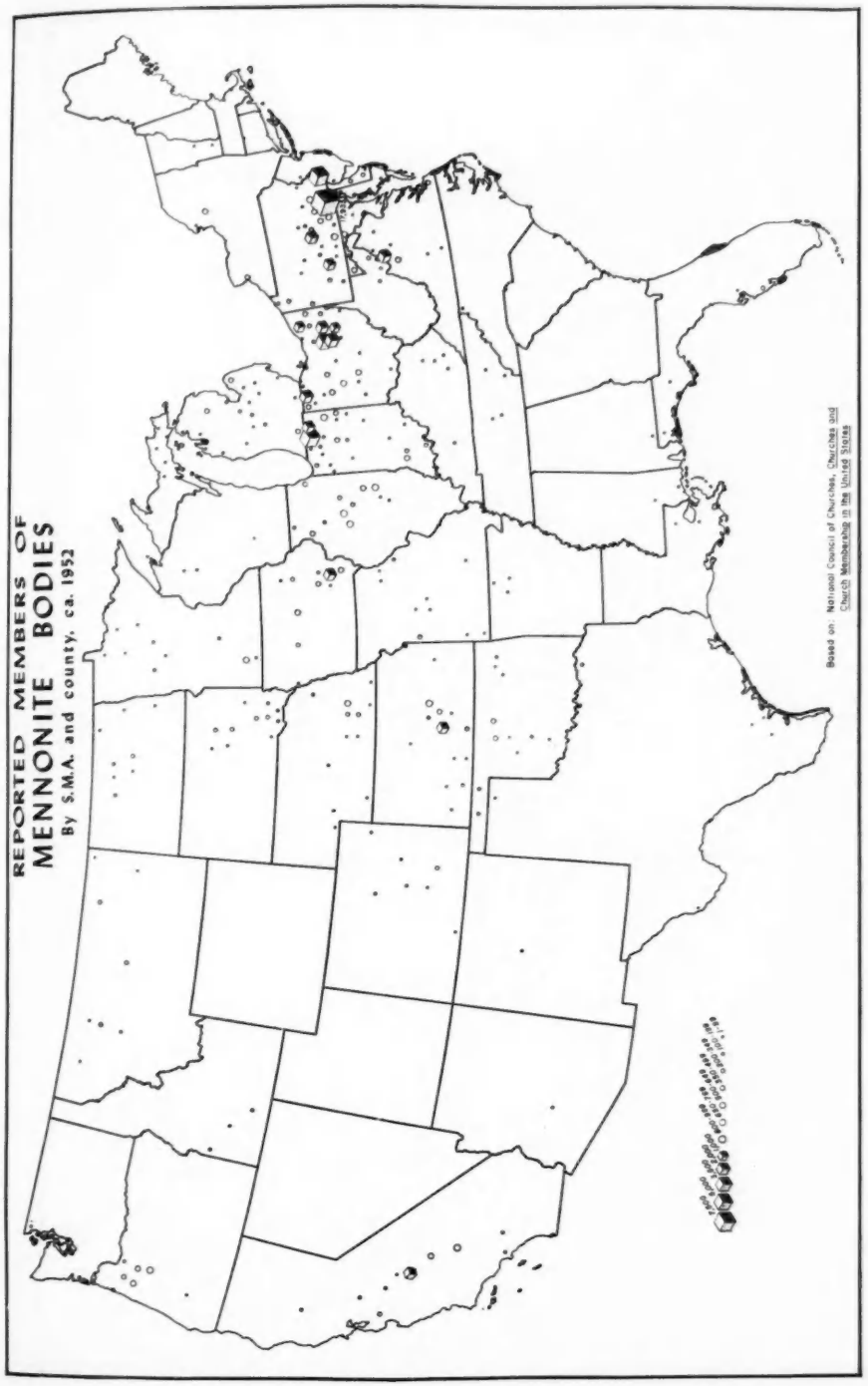
REPORTED MEMBERS OF
MENNONITE BODIES
By S.M.A. and county, ca. 1952
Based on: National Council of Churches, Churches and Church Membership in the United States

FIGURE 22

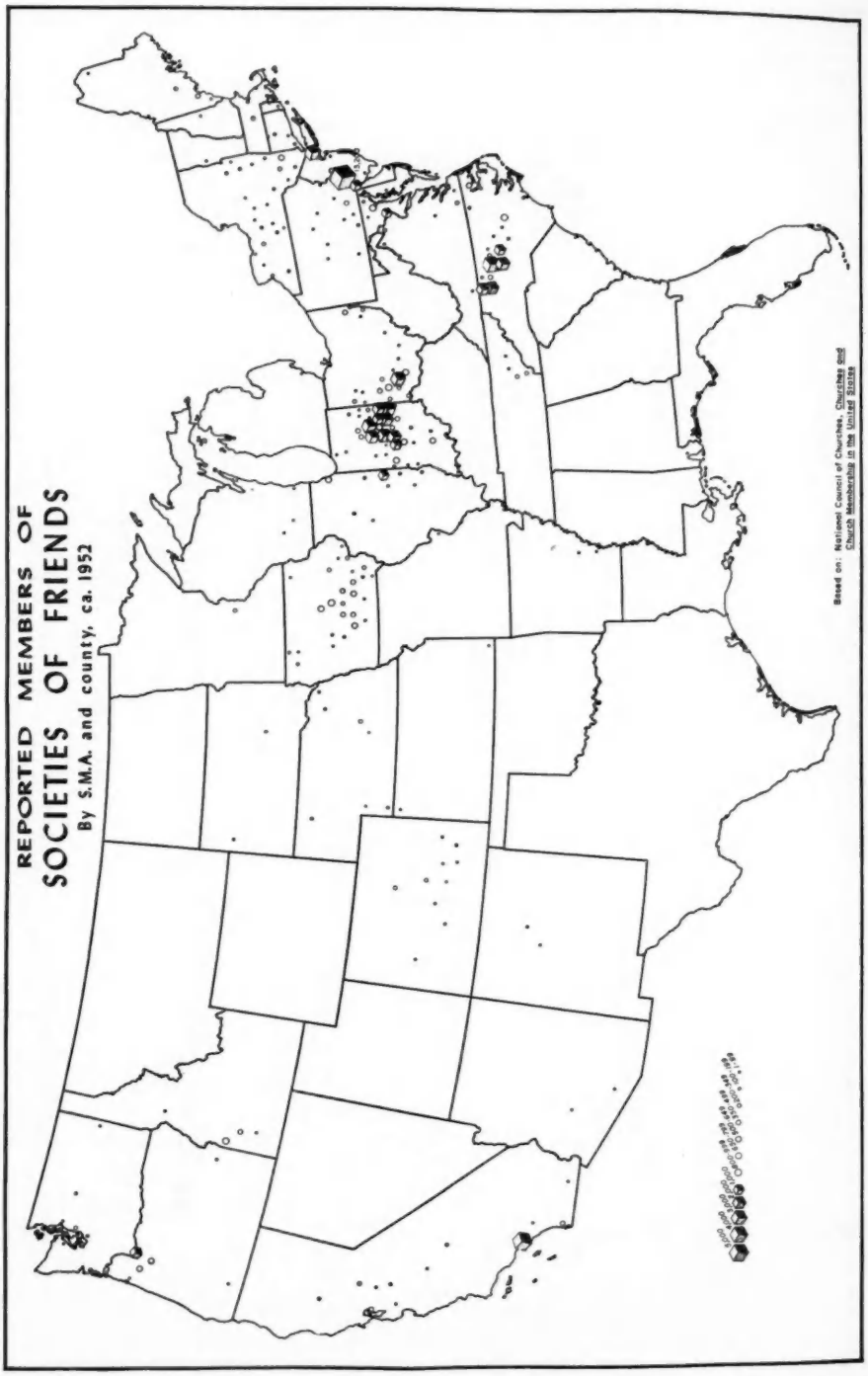
REPORTED MEMBERS OF
SOCIETIES OF FRIENDS
By S.M.A. and county, ca. 1952
Based on: National Council of Churches, Churches and Church Membership in the United States

FIGURE 23

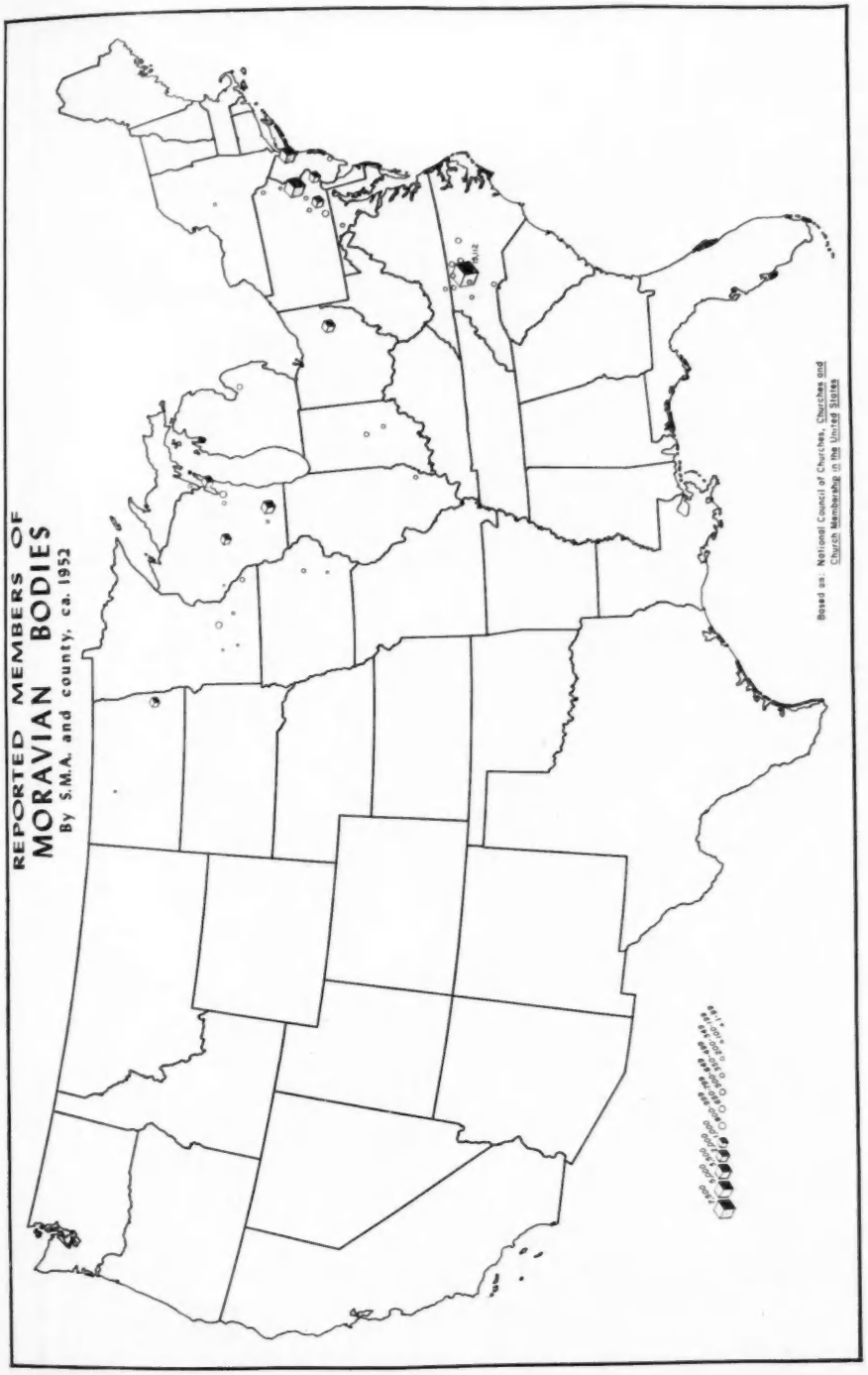
REPORTED MEMBERS OF
MORAVIAN BODIES
By S.M.A. and county, ca. 1952
Based on: National Council of Churches, Churches and Church Membership in the United States

FIGURE 24

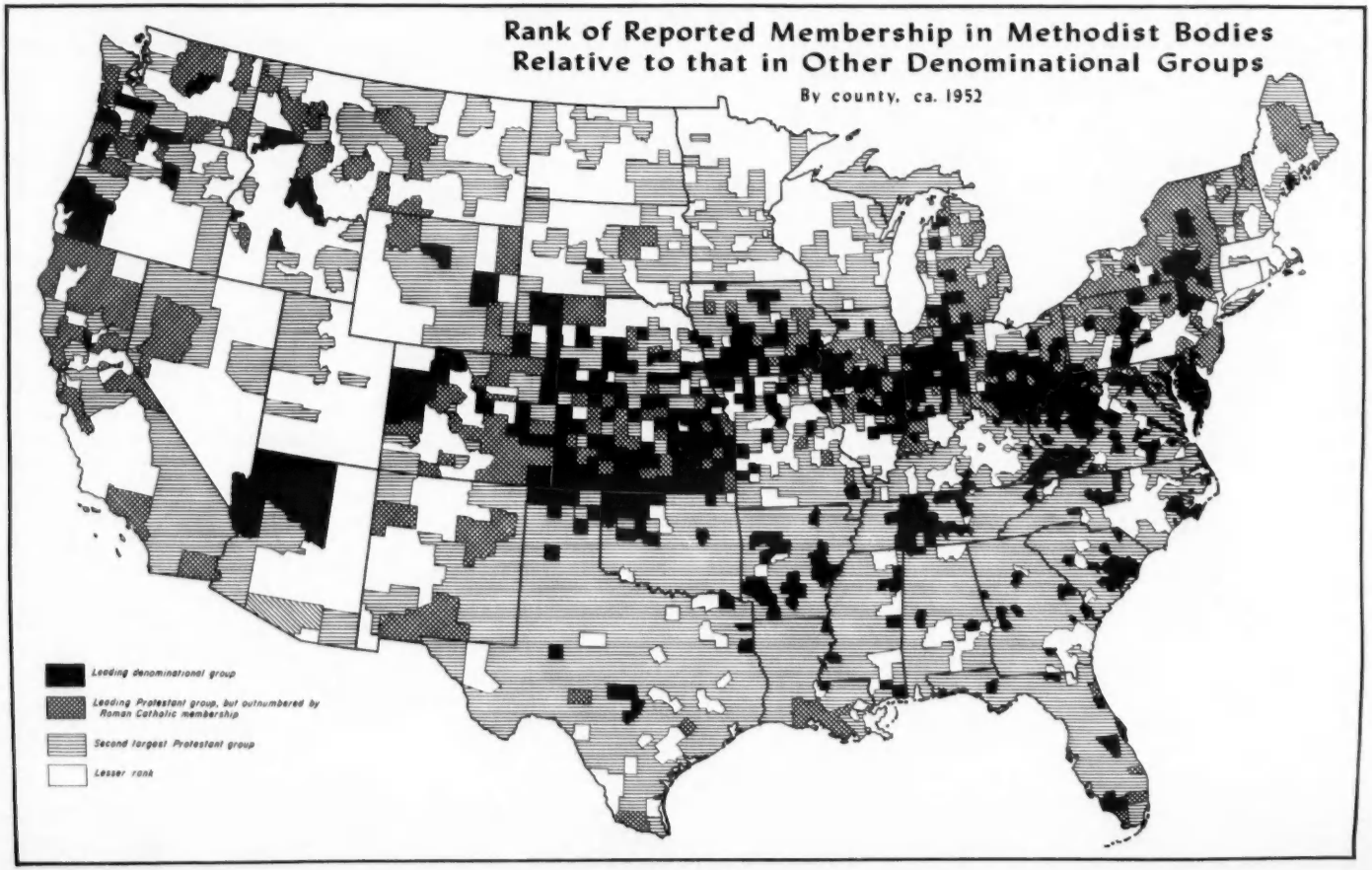
Rank of Reported Membership in Methodist Bodies
Relative to that in Other Denominational Groups
By county, ca. 1952
Leading denominational group
Leading Protestant group, but outnumbered by Roman Catholic membership
Second largest Protestant group
Lesser rank

FIGURE 25

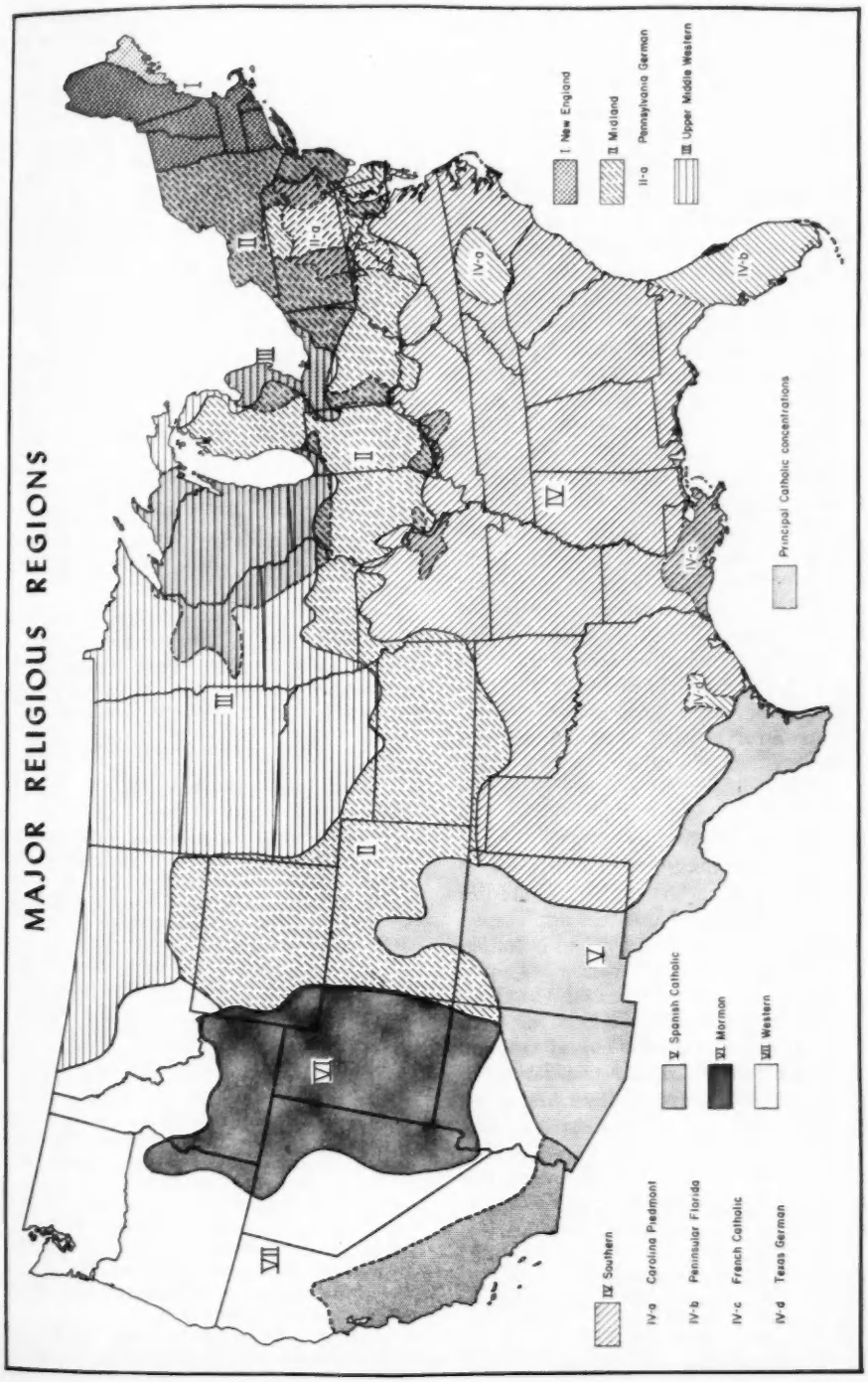

FIGURE 26

FIGURE 25

THE CONCEPT OF LOCATION IN CLASSICAL GEOGRAPHY

F. LUKERMANN
University of Minnesota

THIS paper is a study of the one central theme in geography—location. Although primarily concerned with the origin and early development of that concept in ancient geography, it is also concerned with the significance of the concept today. In the twentieth century geographers have been almost continuously concerned with the relevance of location in the methodological constructions of environmentalism, and landscape or regional geography; yet it remains one of the least well-defined terms in the vocabulary of geographical studies — largely a negative theme and a tool for criticism, rather than an analytic, descriptive concept.

It is from this perspective that classical geography will be examined. If today location is the measure of all things geographic, ". . . the unquestionable possession of our science, our very own, that can be called 'geographic' with a higher right than any other elements . . . ," then it must be the central theme of the earliest geography as well.[1] In addition, the use of location as an analytic, descriptive concept rather than as a tool of criticism can be made clearer in the context of a more primitive usage.

In classical geography, location was used to describe relation, quantity, and process. It was the philosophical "where." The studies in which the concept had greatest application were geography, chorography, and topography as developed under Ionian logography and Hellenistic science. Unfortunately these Greek studies in which the concept was once integral have lost their specific and original meanings, and the successive translation of the original terminology of location into other languages has diffused and transposed their reference.

"Geography" was defined as the demarcation of the earth's surface by processes of world-wide pervasiveness. "Geographical location" was referent solely to natural process. "Chorography" was defined as the description of "given" areas. "Chorographical location" was referent solely to the total relational content within the given area. "Topography" was defined as the order of discrete units one to the other. "Topographical location" was referent solely to the contiguity of places.

Since modern geography has inherited a "confusion of tongues," geography, chorography, and topography have ceased to be methods of description. The vocabulary of location —place, space, region, area—once the sharpest tool of description, has become a methodological orphan. At present the concept of location is sorely in need of rehabilitation, preferably within the context of its ancient home.

Turning to classical geography we may take as our first text the most complete definition of geography and its allied disciplines now extant—the *Geographical Guide* of Claudius Ptolemy.

THE CLASSICAL CONTEXT

It is written in the *Geographike Uphegesis* of Claudius Ptolemy that

> *Geography* is the representation, by a map, of the portion of the earth known to us, together with its general features. Geography differs from *chorography* in that chorography concerns itself exclusively with particular regions and describes each separately, representing practically everything of the lands in question, even the smallest details . . . .
>
> It is the task of *geography* on the other hand, to present the known world as one and continuous, to describe its nature and position, and to include only those things that would be contained in more comprehensive and general descriptions . . . .
>
> Again, *chorography* deals, for the most part, with the nature rather than with the size of the lands. It has regard everywhere for securing a likeness but not, to the same extent, for determining relative positions. *Geography*, on the other hand, is concerned with quantitative rather than with qualitative matters, since it has regard in every case for the correct proportion of distances, but only in the case of the more general features does it concern istelf with securing a likeness, and then only with respect to configuration.
>
> Therefore, chorography has need of *topography*, and no one can be a chorographer unless he is also skilled in drawing. But geography has no such ab-

[1] K. Bürger, *Der Landschaftsbegriff: ein Beitrag zur geographischen Erdraumauffassung*, Dresdner Geographische Studien, Heft 7 (1935), p. 30. Translation by R. Hartshorne, "The Nature of Geography," *Annals*, Association of American Geographers, Vol. 29 (December, 1939), p. 282.

solute need of topography for by using mere lines and annotations it shows positions and general outlines. . . .[2]

The above paragraphs written in the middle of the second century A.D. are generally held to be the source of the modern definitions of geography, chorography, and topography. Those definitions, in what was to be their simplest and most reduced form, were established at the very beginning of the modern period in the work of Varenius and Kant. Since that time they have been much extended in polemic but little altered in essence. Kant, as recorded in his lectures of the late eighteenth century, had reduced the concepts to simply:

> Geography is the description of the whole earth.
>
> Chorography is the description of a more limited area.
>
> Topography is the description of a single place.[3]

Under what conditions and circumstances this cursory categorization by Kant of the Ptolemaic tradition came about is not of direct concern, but it is important to note that it did take place just at the dawn of the most recent methodological awakening. The point of significance is that the elaborate substantive and procedural meaning given in Ptolemy, which is representative of the classical discipline, had been exchanged for a simple classification by form and scale at the beginning of the modern period. Thus any understanding of the classical meaning of the terms from a modern connotation is precluded and specific reference of the classical terms stands completely separated from modern denotation.

An understanding of geography, chorography, and topography in the classical period must be undertaken from internal perspectives. Meaning and reference must come exclusively from the contemporary source material and must be expressed in the classical process of doing geography, chorography, and topography.

In trying to reconstruct the classical discipline it is understood that Ptolemy is neither the epitome nor culmination of classical geographical studies. Rather, he is one of the sources, a source of change and creation as well as a carrier of a continuing tradition and theme. Ptolemy is our last classical source, but in reality he is also a mediate point in a line of intellectual genesis. This is true of all sources. They all have antecedents. They all are antecedents. It is in this context of change and creation that the search is made for a more lucid, operational, and specific meaning of geography, chorography, and topography than we have inherited.

As there is no observed beginning or end of men's thoughts on our subject we may start the analysis with Ptolemy. According to his interpretation, geography is a map (*diagraphos*) of the known world. It is a representation of general features, of an earth

---

[2] The translation into English is by I. E. Drabkin, in R. Cohen and I. E. Drabkin (eds.), *A Sourcebook in Greek Science* (New York, 1948), pp. 162–165, from the Greek–Latin edition of Carolus Müllerus, *Claudii Ptolemaei: Geographia* (Parisiis, 1883). The italics are mine. This translation is preferred to the more literary translation of E. L. Stevenson (ed.), *Geography of Claudius Ptolemy* (New York, 1932). The complete translation of these passages in both the Drabkin and Stevenson editions will be found in the Appendix. Comment on the significance of this introduction in relation to the entire work may be found in L. Bagrow, "The Origin of Ptolemy's Geographia," *Geografiska Annaler*, Vol. 27, Heft 3–4 (1945), pp. 318–387; and H. v. Mžik, *Des Klaudios Ptolemaios Einführung in die darstellende Erdkunde*, Klotho, Bd. 5 (Wien, 1938).

[3] Kant's views are recorded in the F. T. Rink edition of 1802: *Kants Gesammelte Schriften*, Band IX (Berlin und Leipzig, 1923), Immanuel Kants' Physische Geographie, Physische Erdbeschreibung, Einleitung 3. The definition of Varenius was published originally in Latin in 1650. An early English edition was edited by Isaac Newton and further augmented by Jacques Jurin. The French edition translated from the English was published in 1755. The French version is used here: B. Varenius, *Géographie Générale*, Tome Premier (Paris, 1755), pp. 2–4 and 8. An essay by J. N. L. Baker, "The Geography of Bernard Varenius," *Transactions and Papers*, Institute of British Geographers, Vol. 21 (1955), pp. 51–60, discusses the original Latin edition but does not give translations of the pertinent passages. The geographies of P. Cluverius (1624) and N. Carpenter (1625) preserve more of the Ptolemaic tradition and are closer to the sixteenth century geographers than to Varenius and Kant. See: J. N. L. Baker, "Nathaniel Carpenter and English Geography in the Seventeenth Century," *The Geographical Journal*, Vol. 71 (March, 1928), pp. 261–271. G. Frisius, in an enlargement of P. Apian's *Cosmographia* (Antverpiae, 1574), is conceptually classical, maintaining all of Ptolemy's distinctions, especially the critical one that chorography does not compare places one to another or with the world as a whole. See Appendix for extended quotations.

which is one and continuous, of things which would be contained only in a comprehensive description. Geography describes the nature, proportion, position, and configuration of these general features and is, therefore, quantitative in its concern.

Ptolemy has told us what is done in geography. How it is done is not so explicitly stated, but it can be revealed from his own work and other sources. In that revelation it will be made clear that the "general features" to be described are of a comprehensive character because they are consequences of natural processes which are comprehensive in effect. The demarcation of the known earth by natural process, when located and mapped, is geography. Geography is the "writing" on the earth by nature. Geographical location is the relation of places through natural process.

Chorography is the separate description of particular areas. It attempts to describe everything in true likeness. Chorography is not concerned either with the delineation of areas or their comparison.

Ptolemy does not tell us explicitly how chorography is done, but classical studies labeled as chorography reveal the method. Chorography starts with the area as given. All features within the area are described in detail as they actually occur. Any feature or thing described chorographically is, thus, "located" in relation to every other feature within the given region.

Topography is defined by Ptolemy within a chorographic context. The reason for this is clear. Chorography, by describing a feature in terms of its contacting or environing features, is describing the feature by giving it place. To describe the place of a thing is to mark it off by identifying the things that bound it. Topographical description is simply the distribution of anything, or to put it more simply, the location of a thing, i.e. its place.[4]

If what has been said so far is acceptable as a possible digest of Ptolemy's views, and if Ptolemy is in any sense representative of classical research, it should be possible to analyze other sources in a similar way. This is not to presuppose that classical scholars were any more in agreement than modern scholars, but some general consensus must be postulated before we can talk about a discipline at all. That is why we have talked rather loosely about being able to *reveal* the process of doing geography from the source material, even though we have not found in the Ptolemaic source an explicit statement on how to do geography, chorography, and topography.

What follows is an attempt to substantiate, as acceptable general statements for the classical period, the methods and processes of doing geography, chorography, and topography. The essence of all the methods is *location*—the placement of things.

Geography = the place of natural process acting everywhere upon the known earth.

Chorography = the integral place of all parts of a given whole.

Topography = the place of a discrete unit, series or group of units.

Having established an arbitrary end to the classical period with Ptolemy we turn now to its beginning. We will seek to establish in Homer the recognizable roots of geo-description, choro-description, and topo-description.

THE GEOGRAPHICAL IDIOM

Strabo and Eratosthenes, in recounting the origins of their discipline, looked back to Homer as their earliest source; not because they found "geography," "chorography," and "topography" in the poet, for they did not, but rather because they found a way of thinking, an epithetical pattern of speech relating man to place, which they themselves used. These nuclear elements of earth description found in the poets are the earliest methodological source materials of any extent which reveal the process of thinking geographically. In Homer, in the Homeric Cycle, in Hesiod,

[4] This is essentially the meaning L. Martin wished to give to "topographic" *vis-à-vis* the Kantian definition given by P. E. James in "The Terminology of Regional Description," *Annals*, Association of American Geographers, Vol. 24 (June, 1934), pp. 78–92. Exposition of the currently prevailing Kantian definitions may be found in P. E. James, "Toward a Further Understanding of the Regional Concept," *Annals*, Association of American Geographers, Vol. 42 (September, 1952), pp. 195–222, especially pp. 212 ff. An attempt to link the classical and modern viewpoints on chorography (beyond Kant) is given in E. Van Cleef, "A Stratigraphic View of Geography," *Science*, Vol. 83 (April, 1936), pp. 313–317.

in Aeschylus, and the dramatists, the inter-relating of man and his surroundings, i.e. the knowledge of place, first becomes a recognizable pattern of expression in literature. How to describe "where something is" becomes idiomatic in Western culture.

This birth of a discipline is recognized by the earliest classical geographers, but is perhaps best summarized by Strabo.

> Generally speaking, it is wrong to place the poetry of Homer on the same level with that of other poets, and to decline to rank him above them in any respect, and particularly in the subject that now occupies our attention, namely, geography. For if you did no more than go over the *Triptolemus* of Sophocles or the prologue to the *Bacchae* of Euripides, and then compare Homer's care with respect to geographical matters, it would be easy for you to perceive this difference, which lies on the surface. Indeed, wherever there is need of an orderly sequence in the place he mentions, Homer is careful to preserve that order, not only in regard to places in Greece, but equally in regard to those beyond the limits of Greece.[5]

The use of the epithet to identify places is characteristically and familiarly Homeric, as are the itineraries, whether of Gods or men.

> . . . they that held the *hollow land* of Lacaedaemon with its many ravines . . . .
>
> . . . and *vine-clad* Epidarus . . . .
>
> . . . Lyctus and Miletus and Lycastus, *white with chalk*, and Phaestus and Phytium, *well-peopled* cities; and all they beside that dwelt in Crete *of the hundred cities*.
>
> . . . them that dwelt in *deep-soiled* Larisa . . . .

and

> . . . captains from *afar*, from Alybe, where is the *birthplace of silver*.[6]
>
> . . . Hera darted down and left the peak of Olympus; on Pieria she stepped and lovely Emathia, and sped over the snowy mountains of the Thracian horsemen, even over their topmost peaks, nor grazed she the ground with her feet; and from Athos she stepped upon the billowy sea, and so came to Lemnos, the city of godlike Thoas. There she met Sleep the brother of Death and she clasped him by the hand. . . .[7]

Beyond these snippets of areal description and allegorical topographies Strabo further declares Homer to busy himself

> . . . about the geography both of the individual countries and of the inhabited world at large, both land and sea; for otherwise he would not have gone to the uttermost bounds of the inhabited world, encompassing the whole of it in his description.[8]

Particularly cited is Homer's world view: that the *oikoumene* is surrounded by "Oceanus that floweth ever back upon himself." This reference to tidal action and further references to temperature regions and the position of the earth under the heavens are taken as the first evidence of man's analysis of earth features as demarcated by nature's universal processes.[9]

More sophisticated to modern ears are the geographical idioms of the Cycle and Hesiod.

> There was a time when the countless tribes of men, though wide-dispersed, oppressed the surface of the deep-bosomed earth, and Zeus saw it and had pity and in his wise heart resolved to relieve the all-nurturing earth of men by causing the great struggle of the Ilian war, that the load of death might empty the world. And so the heroes were slain in Troy, and the plan of Zeus came to pass.[10]
>
> When the Pleiades, daughters of Atlas, are rising, begin your harvest, and your ploughing when they are going to set. Forty nights and days they are hidden and appear again as the year moves round, when first you sharpen your sickle. This is the law of the plains, and of those who live near the sea, and who inhabit rich country, the glens and dingles far from the tossing sea,—strip to sow and strip to plough and strip to reap, if you wish to get in all Demeter's fruits in due season, and that each kind may grow in its season.[11]

Thus at the birth of alphabetic writing in Greece, before the sixth century B.C. and probably as part of an oral tradition going back to Achaean/Mycenaean times of the second millenium, there is a literature, geographic in content if not in name, identifying a method of description and observation undeniably analytic and empirical.

In the next three centuries what had been a geographical idiom became a literature. Descriptions exclusively devoted to the distribution or place-relation of earth features and human events were published by the Ionian

[5] H. L. Jones, *The Geography of Strabo*, Loeb Classical Library (London, 1927), Book I, 2, 20, also Book I, 1, 2. An alternative English translation is H. C. Hamilton and W. Falconer, *The Geography of Strabo*, Bohn's Classical Library (London, 1903), in three volumes with the same notation.

[6] From the "Catalogue of Ships" in Book II of A. T. Murray, *The Iliad*, Loeb Classical Library (London, 1923), 560, 580, 645, 840, 855. The italics are mine.

[7] *The Iliad*, Book XIV, 225. See also H. W. Smith, *Aeschylus*, Loeb Classical Library (London, 1922), "Prometheus Bound," 707 ff.

[8] *The Geography of Strabo*, Book I, 1, 2.

[9] *The Geography of Strabo*, Book I, 1, 2–11.

[10] H. G. Evelyn-White, *Hesiod, the Homeric Hymns and Homerica*, Loeb Classical Library (London, 1914), "The Cypria," 3.

[11] *Hesiod, et al.*, "Works and Days," 383.

logographers. Along with the sciences and history, geographical study became a more structured inquiry and consequently became a more narrow and specific field of observation and analysis. Although there was as yet no rubric such as "geography," "chorography," and "topography," to designate these studies, the root words *ge*, *choros*, and *topos* were becoming generic in their application to certain conditions and types of description—descriptions which we have already identified in the poetic literature.

Hecataeus of Miletus is generally credited with the first specific work of geographical significance among Ionian prose writers. It exists only in *fragmenta* and *testimonia*, but it is fairly certain that the title was either *Ges Periodos* ("Circuit of the Earth") or *Periegesis* ("About or Around the Earth"), and that it was divided into two books, *Europe* and *Asie*.[12] It was a description of the known world not unlike the itineraries of Homer and Aeschylus and those associated with the telling of the voyage of the Argonauts, but was ordered as to direction and sequence of peoples and places away from the Aegean and along the coasts of the inner seas and outer Ocean.[13] Interior places and peoples were appended when known with their closest approaching coasts. Hecataeus is only one of many writers of such descriptions variously titled *Ges Periodos*, *Periegesis*, and *Periplous* ("About or Around the Coasts"), all essentially structured as topographies and only incidentally as descriptions of environmental differences or descriptions of peoples.

> . . . (Hecataeus of Miletus) says in his *Circuit of the Earth*: "Near the city Alazia is the River Odrysses, which flows out of Lake Dascylitis from the west through the plain of Mygdonia and empties into the Rhyndacus." But he goes on to say that Alazia is now deserted and that many villages of the Alazones, through whose country the Odrysses flows, are inhabited, and that in these villages Apollo is accorded exceptional honour, and particularly on the confines of the Cyziceni. Menecrates in his work entitled *The Circuit of the Hellespont* says that above the region of Myrleia there is an adjacent mountainous tract which is occupied by the tribe of the Halizones.[14]

The logographers in general contributed much geographical material although their major interest may have lain elsewhere. A fragment of Thales of Miletus on the Delta is an example of one type. The map attributed to Anaximander of Miletus is another. Hippocrates of Cos in his comparison of Greece and Asia Minor is a third.

> Now that we have discussed the sources and course of the Nile we shall endeavour to set forth the causes of its swelling. Thales, who is called one of the seven wise men, says that when the etesian winds blow against the mouths of the river they hinder the flow of the water into the sea, and that this is the reason why it rises and overflows Egypt, which is low and a level plain. But this explanation, plausible as it appears may easily be shown to be false. For if what he said were true, all the rivers whose mouths face the etesian winds would rise in a similar way; but since this is the case nowhere in the inhabited world the true cause of the swelling must be sought elsewhere.[15]
>
> . . . It was in the reign of Cleomenes that Aristagoras the despot of Miletus came to Sparta . . . he brought with him a bronze tablet on which the map of all the earth was engraved, and all the sea and all the rivers.
>
> . . . And the lands wherein they dwell lie next to each other, as I shall show you:—here are the Ionians, and here the Lydians, who inhabit a good land and have great store of silver (showing as he spoke the map of the earth which he had brought engraved on the tablet) "and next to the Lydians" (said Aristagoras in his speech) "you see the Phrygians, to the east, men that of all known to me are the richest in flocks and in the earth's produce. Close by them are the Cappadocians, whom we call Syrians; and their neighbours are the Cilicians, whose land reaches to the sea yonder; wherein you see the island of Cyprus lying . . . ."[16]
>
> . . . I hold that Asia differs very widely from Europe in the nature of all its inhabitants and of all its vegetation. For everything in Asia grows to far greater beauty and size; the one region is less wild than the other, the character of the inhabitants is milder and more gentle. The cause of this is the temperate climate, because it lies towards the east midway between the risings of the sun, and farther away than is Europe from the cold. Growth and freedom from wildness are most fostered when

[12] G. Nenci, *Hacataei Melesii Fragmenta* (Firenze, 1954). L. Pearson, *Early Ionian Historians* (Oxford, 1939), pp. 25–108.

[13] On Argonauts see R. C. Seaton, *Appollonius Rhodius: The Argonautica*, Loeb Classical Library (London, 1912), Book II, 340–407 and Book IV, 235–337.

[14] *The Geography of Strabo*, Book XII, 3, 22. On later *Periploi* see A. Diller, *The Tradition of the Minor Greek Geographers*, American Philological Association Monographs, No. 14 (Lancaster, 1952).

[15] C. H. Oldfather, *Diodorus of Sicily*, Loeb Classical Library (London, 1933), Book I, 38. D. R. Dicks, "Thales," *The Classical Quarterly*, Vol. 9 (November, 1959), pp. 294–309.

[16] A. D. Godley, *Herodotus*, Loeb Classical Library (London, 1922), Book V, 49.

nothing is forcibly predominant, but equality in every respect prevails. Asia, however, is not everywhere uniform; the region, however, situated midway between the heat and the cold is very fruitful, very wooded and very mild; it has splendid water, whether from rain or from springs. While it is not burnt up with the heat nor dried up by drought and want of water, it is not oppressed with cold, nor yet damp and wet with excessive rains and snow. Here the harvests are likely to be plentiful, both those from seed and those which the earth bestows of her own accord, the fruit of which men use, turning wild to cultivated and transplanting them to a suitable soil.[17]

It is in Herodotus, however, that there is preserved the greater part of the Ionian geographical contribution. Within his *Histories* are long passages solely devoted to the description of *topos* and *choros* — place and country. In the descriptions of Egypt, Libya, and Scythia, in Books II and IV, the argument is classically geographical. Where is this place? What is the nature of this place and its occupants? What is the form and size of this place?

Now if we agree with the opinion of the Ionians, namely that nothing but the Delta is Egypt, whereof the seaboard reaches, according to them, from what is called the watchtower of Perseus, forty schoeni to the salting factories of Pelusium, while inland it stretches as far as the city of Cercasorus, where the Nile divides and flows thence to Pelusium and Canobus (all the rest of Egypt being, they say, partly Libya and partly Arabia); if we follow this account, we can show that there was once no country for the Egyptians; for we have seen that (as the Egyptians themselves say, and as I myself judge) the Delta is alluvial land and but lately (so to say) come into being.[18]

The country of Cyrene, which is the highest part of that Libya which the nomads inhabit, has the marvellous boon of three harvest seasons. First on the sea-coast the fruits of the earth are ripe for reaping and plucking; when these are gathered, the middle region above the coast, that which they call the Hills is ripe for gathering: and no sooner is this yield of the middle country gathered than the highest-lying crops are mellow and ripe, so that the latest fruits of the earth are coming in when the earliest are already spent by way of food and drink. Thus the Cyrenaeans have a harvest lasting eight months.[19]

. . . The Scythian race has in that matter which of all human affairs is of greatest import made the cleverest discovery that we know: I praise not the Scythians in all respect, but in this greatest matter they have so devised that none who attacks them can escape, and none can catch them if they desire not to be found. For when men have no established cities or fortresses, but all are house-bearers and mounted archers, living not by tilling the soil but by cattle-rearing and carrying their dwellings on waggons, how should these not be invincible and unapproachable?

This invention they have made in a land which suits their purpose and has rivers which are their allies; for their country is level and grassy and well watered and rivers run through it not greatly fewer than the canals of Egypt.[20]

Finally in Xenophon and Aristotle a certain synthesis is reached. Principles and generalizations which had slowly been gathered together after centuries of experience with the Aegean environment and culture were put to practical purpose. Xenophon in the essay on *Ways and Means* showed his fellow Athenians that prosperity and power lay in their "geography" if they would but recognize it.

Now as I thought over my ideas, one thing seems clear at once, that the country is by its nature capable of furnishing an ample revenue. To drive home the truth of this statement I will first describe the natural properties of Attica.

The extreme mildness of the seasons here is shown by the actual products. At any rate, plants that will not even grow in many countries bear fruit here. Not less productive than the land is the sea around the coasts. Notice too that the good things which the gods send in their season all come in earlier here and go out later than elsewhere. And the preeminence of the land is not only in the things that bloom and wither annually: she has other good things that last forever. Nature has put in her abundance of stone, from which are fashioned lovely temples and lovely altars, and goodly statues for the gods. Many Greeks and barbarians alike have need of it. Again, there is land that yields no fruit if sown, and yet, when quarried, feeds many times the number it could support if it grew corn. And recollect, there is silver in the soil, the gift, beyond doubt, of divine providence: at any rate, many as are the states near to her by land and sea, into none of them does even a thin vein of silver ore extend.

One might reasonably suppose that the city lies at the center of Greece, nay of the whole inhabited world. For the further we go from her, the more intense is the heat or cold we meet with; and every traveller who would cross from one to the other end of Greece passes Athens as the centre of a circle, whether he goes by water or by road. Then too, though she is not wholly sea-girt, all the winds of heaven bring to her the goods she needs and bear away her exports, as if she were an island; for she lies between two seas: and she has a vast land trade as well; for she is of the mainland. Further, on the borders of most states dwell barbarians who trouble them: but the neighbouring

[17] W. H. S. Jones, *Hippocrates*, Loeb Classical Library (London, 1923), Vol. I, "Airs Waters Places," XII.

[18] *Herodotus*, Book II, 15.

[19] *Herodotus*, Book IV, 199.

[20] *Herodotus*, Book IV, 46–47.

states of Athens are themselves remote from the barbarians.

All these advantages, as I have said, are, I believe, due to the country itself . . . .[21]

Aristotle, tutor of Alexander the founder of a hundred cities, wrote the prolegomena of "planning" as a study in location theory.

. . . The proper configuration of the country it is not difficult to state . . . : on the one hand it should be difficult for enemies to invade and easy for the people themselves to march out from, and in addition, on the other hand, the same thing holds good of the territory that we said about the size of the population—it must be well able to be taken in at one view, and that means being a country easy for military defence. As to the site of the city, if it is to be ideally placed, it is proper for it to be well situated with regard both to the sea and to the country. One defining principle is that mentioned above—the city must be in communication with all parts of the territory for the purpose of sending out military assistance; and the remaining principle is that it must be easily accessible for the conveyance to it of the agricultural produce, and also of timber-wood and any other such material that the country happens to possess.[22]

THE METHODOLOGY OF DESCRIPTION

Xenophon (a pupil of Socrates) and Aristotle (a pupil of Plato) represent a new approach to inquiry just becoming coherent in the Athens of the fourth century B.C. A synthesis was being made of all knowledge, drawing together threads from many sources, Oriental as well as Greek. One aspect of this synthesis, particularly pertinent in the genesis of the geographical discipline, was the attempt of Plato, Aristotle, and Theophrastus to provide a logical structure to the study of cosmography: that is, the position of the earth in the Universe directly conditions any analysis of the effect of universal processes on the earth's surface. To describe the *general* features of the known world predicates *general* principles of explanation, and explanation involves first of all a definition of terms.

The words *ge*, *choros*, and *topos* are the terms of interest. The meaning and reference of *ge* is no problem. For the geographer and in geographical description it has always referred to the known earth, that is, the *oikoumene*. As to classical knowledge, there was no part of the known world of any great extent that was uninhabited.

The words *choros* and *topos* are a problem particularly in their translation into other languages. This confusion in the Latin and English/French/German analogues of the Greek fortunately does not apply to the Greek connotation of the words themselves. In classical Greek usage and in Aristotle's explication of the terms there is little variation or range in meaning. We may take as standard the following definition of the words for classical literature.

Choros should never be translated as space (*spatium*) if the connotation of that word is "empty" or "absolute" space, i.e. implies extension or duration without the presence of a body or thing. The Greek word for absolute or empty space was *kenos* (void) or *chaos*. *Choros* literally means "room" and may safely be translated in context as area, region (*regio*), country (*pays*) or space/place—if in the sense of the boundary of an area. *Choros* technically means the boundary of the extension of some thing or things. It is the container or receptacle of a body.

One of the earliest philosophical examinations of *choros* is in the *Timaeus* of Plato which probably borrows heavily from Pythagorean doctrine as viewed by Parmenides.[23]

[21] E. C. Marchant, *Xenophon: Scripta Minora*, Loeb Classical Library (London, 1925), "Ways and Means" I.

[22] H. Rackham, *Aristotle: The Politics*, Loeb Classical Library (London, 1932), Book VII, V, 2.

[23] Parmenides is usually credited with implementing the concept of a celestial sphere as a grid under which a spherical earth is "zoned." The five celestially defined zones of Parmenides should not be confused with the later *klimata* of classical geography. In questions relating to the general development of classical geography such as origin of concepts, chronology, and the general philosophy of science, I have consulted the standard works in the field. These secondary sources have not been footnoted in every instance: H. Berger, *Geschichte der wissenschaftlichen Erdkunde der Griechen* (Leipzig, 1891, 1903); E. L. Bunbury, *A History of Ancient Geography* (London, 1879, 1883), two volumes; A. Forbiger, *Handbuch der Alten Geographie* (Hamburg, 1842, 1877), three volumes; F. Gisinger, "Geographie" in G. Wissowa and W. Kroll (eds.), *Paulys Real-Encyclopädie der Classischen Altertumswissenschaft*, Neue Bearbeitung, Supplementband IV (Stuttgart, 1924), pp. 522–683; W. A. Heidel, *The Frame of the Ancient Greek Maps* (New York, 1937); C. van Paassen, *The Classical Tradition of Geography* (Groningen, 1957); G. Sarton, *A History of Science* (Cambridge, 1959), two volumes; J. O. Thomson, *History of Ancient Geography* (Cambridge, 1948); E. H. Warmington, *Greek Geography*, The Library of Greek Thought (London, 1934); J. K. Wright, *Geographical Lore of the Time of the Crusades* (New York, 1925).

Choros in the cosmographical context of the place of Being is usually translated as space, but space here obviously means the place where something is.[24]

The most extensive analysis of *choros/topos* in classical literature is in Aristotle. In his discussion of *topos* he uses the term *choros* exclusively in the sense of area—an extended place. In both the *Organon* and in the *Physics, choros* is always identified with a body and distinguished from the concept of void; but it is in the *Physics* that the intimate link between *choros* and *topos* is made explicit.[25] There more than in any other place in classical literature, the dependence of chorography upon topography is clarified. *Choros* and *topos* are the relationship of things. There is no space or place without things. On the other hand, we cannot mean by the place of something, or the space of something, the thing itself. We must mean by *choros* and *topos*, space and place as the relative position of things one to another.[26]

Aristotle sums up the meaning of *topos* by saying that place is continuous and quantitative; it is the common boundary of parts and, therefore, has position and is limited.

> . . . a "place" may be assigned to an object either primarily because it is its special and exclusive place, or mediately because it is "common" to it and other things, or is the universal place that includes the proper place of *all* things.
>
> I mean, for instance, that you, at this moment, are in the universe; and in the air because on the earth; and in like manner on the earth because on the special place which "contains and circumscribes you, and nothing but you."[27]

and so:

> . . . whatever fixed environing surface we take our reckoning from will be the place.[28]

and finally:

> . . . "the place" means the boundary of that which encloses it.[29]

Aristotle has, then, no absolute concept of either space or place. From all perspectives his concept is relative. Place or space description is simply an analysis of relative location. For topography this can only mean location relative to contiguous parts, and for chorography only location relative to the common areal boundary, i.e. the given whole.

The pupil of Aristotle, Theophrastus, is generally cited for bringing the discussion of space/place to its penultimate logical conclusion: that it is the order and place of bodies in relation to each other.[30] It seems wise, considering these arguments, to limit the translation of *topos* in context to place, location (*locus*) or space — if in the strict sense of spatial relationship.

THE SCIENCE OF GEOGRAPHY

Studies in topography and chorography continued with virtually no methodological change between the fourth century B.C. and the time of Ptolemy. The change that did occur was largely a greater specialization of description and the multiplication of *Periploi* and *Periodoi*, either as independent treatises or books of multiple volume histories. As might be expected, a more sophisticated treatment and a more variegated content characterized the later works as the Hellenistic age endured and spread.

Ephorus, the historian, is an example of this

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[24] F. M. Cornford, *Plato's Cosmology* (New York, 1957), translation and commentary, pp. 191–197 and footnote p. 200. A. E. Taylor, *A Commentary on Plato's Timaeus* (Oxford, 1928), pp. 312 ff., 348–351, 681–689.

[25] H. P. Cooke, *Aristotle: the Organon*, Loeb Classical Library (London, 1938), Vol. I, VI. P. H. Wicksteed and F. M. Cornford, *Aristotle: the Physics*, Loeb Classical Library (London, 1929), Vol. I, Book IV.

[26] W. D. Ross, *Aristotle's Physics* (Oxford, 1936), pp. 370–377 and 53–58; *Commentary on Plato's Timaeus*, Appendix III: "Aristotle's Doctrine of Space," pp. 664–677; *Essays in Honour of Gilbert Murray* (London, 1936), essay by F. M. Cornford, "The Invention of Space," pp. 215–235. In a modern context Aristotle's argument is essentially that space/place is relation and is, therefore, a parametric system. *Place* exists only as a frame of reference.

> Then what kind of thing must we conceive "a place" to be? Its properties forbid us to think of it either as being an element itself or as being compounded of elements—whether physical or conceptual. For it has dimensional extension, which conceptual components could not give it; but it is not a body, which it would necessarily be if compounded of elements cognizable by sense.
>
> Again, how are we to suppose that place affects or determines things in any way? For it cannot be brought under any one of the four causal or essential determinants:—not as the "material" of things, for nothing is composed of it; nor as their "form" or constituent definition; nor as their contemplated "end"; nor as setting them in motion, or otherwise changing them. *The Physics*, Vol. I, Book IV, I.

[27] *The Physics*, Vol. I, Book IV, II.

[28] *The Physics*, Vol. I, Book IV, V.

[29] W. K. C. Guthrie, *Aristotle: On the Heavens*, Loeb Classical Library (London, 1939), Book IV, III.

[30] C. J. de Vogel, *Greek Philosophy* (Leiden, 1953), Volume II, pp. 237–238. Fragments 21 and 22 of Theophrastus from the Wimmer edition of Simplicius.

sophistication in combining chorographic/topographic description, as are Polybius and Arrian.

> Ephorus declares that Boeotia is superior to the countries of the bordering tribes, not only in fertility of soil, but also because it alone has three seas and has a greater number of good harbours; in the Crisaean and Corinthian Gulfs it receives the products of Italy and Sicily and Libya, while in the part which faces Euboea, since its seaboard branches off on either side of the Euripus, on one side towards Aulis and the territory of Tanagra and on the other towards Salganeus and Anthedon, the sea stretches unbroken in the one direction towards Egypt and Cyprus and the island, and in the other direction towards Macedonia and the regions of the Propontis and the Hellespont. And he adds that Euboea has, in a way, been made a part of Boeotia by the Euripus, since the Euripus is so narrow and is spanned by a bridge only two plethra long. Now he praises the country on account of these things; and he says that it is naturally well suited to hegemony, . . .[31]

Of topography proper, Pliny's description of the Taurus is exemplary and undoubtedly borrows much from his predecessors.

> . . . It is itself an immense range, and holds the balance between a countless number of tribes; its right-hand side, where it first rises out of the Indian Ocean, faces north, and its left-hand side faces south; it also stretches westward, and would divide Asia in two at the middle, were it not that in dominating the land it encounters the opposition of seas. It therefore recoils in a northerly direction, and forming a curve starts on an immense route, nature as it were designedly throwing seas in its way at intervals, here the Phoenician Sea, here the Pontus, there the Caspian and the Hyrcanian, and opposite to them Lake Maeotis. Consequently owing to their impact the mountain twists about between these obstacles, and nevertheless sinuously emerging victorious reaches the kindred ranges of the Ripaean Mountains.[32]

A more specific type of chorographic description is scattered throughout Strabo and is most often attributed to the "Chorographer"; but the description has a conventional formula used throughout the classical period. The technique was to find a natural and geometric figure in which to frame the regional description. As might be expected, there was difficulty in getting consensus over what was a natural boundary and whether it formed a recognizable geometric figure. Apollodorus especially aroused Strabo's ire in describing Asia Minor, Strabo's native area.

> . . . But the greatest absurdity is this, that, after calling the peninsula triangular in shape, he represents the "exterior sides" as three in number; for when he speaks of the "exterior sides" he seems privily to exclude the side along the narrows, as though this too were a side, but not "exterior" or on the sea. If, then, these narrows were so shortened that the exterior side ending at Issus and that ending at Sinope lacked but little of joining one another, one might concede that the peninsula should be called triangular; but, as it is, since the narrows mentioned by him leave a distance of three thousand stadia between Issus and Sinope, it is ignorance and not knowledge of chorography to call such a four-sided figure triangular. Yet he published in the metre of comedy a work on chorography entitled *A Description of the Earth* (*Ges Periodon*).[33]

The difficulty in finding a figure such as a leaf or triangle on which to hang one's chorography led to a pseudo-comparative method of describing a place or area in terms of another place or area. Polybius employed this method to advantage in describing the Hellespont by using the Pillars of Hercules as an analogue more familiar to his Roman readers. Sicily and the Peloponnesus are similarly compared.[34] Self-confessed geographers and chorographers like Strabo and Eratosthenes, however, continued to search for natural and geometrical analogues because "the representation of non-geometrical figures is not easy to describe."[35]

A truly comparative chorography, more precisely a topographic chorography, was never fully developed in classical literature. Incipient examples, again, are found largely in the historians rather than among the chorographers. Herodotus is the best early example developing an areal comparison of cultures explained by a topographical description, in this instance by cultural diffusion.

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[31] *The Geography of Strabo*, Book IX, 2, 2. See also W. R. Paton, *Polybius: The Histories*, Loeb Classical Library (London, 1923), Book V, 21–22; E. I. Robson, *Arrian: Anabasis Alexandri*, Loeb Classical Library (London, 1929), Book III, 4; and G. L. Barber, *The Historian Ephorus* (Cambridge, 1935).

[32] H. Rackham, *Pliny: Natural History*, Loeb Classical Library (London, 1947), Book V, 27. Compare with *Anabasis Alexandri*, Book V, 5–6.

[33] *The Geography of Strabo*, Book XIV, 5, 22. Chorographic description by the means of distinctive configuration is found as early as the Ionian logography. Herodotus, in describing Asia and Libya, referred to the lands as distinctive promontories (*aktai*); eventually Eratosthenes "regionalized" the whole *oikoumene* into conventional shaped parts called *sphragidas* (seals) and *plinthia* (bricks). See *Herodotus*, Book IV, 38; *The Geography of Strabo*, Book II, 1, 22; 1, 24; 1, 35; Book XV, 1, 26.

[34] *Polybius*, Book I, 41–42; Book XVI, 29.

[35] *The Geography of Strabo*, Book V, 1, 2.

> For it is plain to see that the Colchians are Egyptians; and this that I say I myself noted before I heard it from others. When I began to think on this matter, I inquired of both peoples; and the Colchians remembered the Egyptians better than the Egyptians remembered the Colchians; the Egyptians said that they held the Colchians to be part of Sesostris' army. I myself guessed it to be so, partly because they are dark-skinned and woolly-haired; though that indeed goes for nothing, seeing that other peoples, too, are such; but my better proof was that the Colchians and Egyptians and Ethiopians are the only nations that have from the first practised circumcision. The Phoenicians and the Syrians of Palestine acknowledged of themselves that they learnt the custom from the Egyptians, and the Syrians of the valleys of the Thermodon and the Parthenius, as well as their neighbours the Macrones, say that they learnt it lately from the Colchians. These are the only nations that circumcise, and it is seen that they do even as the Egyptians. But as to the Egyptians and Ethiopians themselves, I cannot say which nation learnt it from the other; for it is manifestly a very ancient custom. That the others learnt it from intercourse with Egypt I hold to be clearly proved by this—that Phoenicians who hold intercourse with Hellas cease to imitate the Egyptians in this matter and do not circumcise their children.[36]

Later examples are found in fragments and epitomes collected in Diodorus Siculus and Arrian for their descriptions of India, Arabia, and Ethiopia. Most notable is the regionalization of lands bordering the Erythraean Sea on the basis of the dietary habits of the inhabitants as recorded by Artimodorus and Agatharchides.[37] Arrian, based on Megasthenes and Onesicritus as well as on Artimodorus and Agatharchides, compared the peoples, cultures, fauna, climate, and landforms of India and Ethiopia in his *Indica*. There, however, because of the "natural" explanation offered for similar cultures, *et al.*, it would be more exact to classify the method of comparison as a geographic chorography. Natural process is the "locating" factor rather than cultural diffusion as in the case from Herodotus.[38]

It is with the geographic rather than the chorographic/topographic context that the last four centuries of the classical period are usually identified in the genesis of the discipline. The "science" of geography had begun with the construction of the Ionian world map, and ever since the most compelling theme had been its reform. It was in this reform that Aristotle had made his greatest substantive contribution to the field, and it is in this type of study that the greatest advances in later knowledge were to be made. The reform started much earlier than with Herodotus but his objections are the earliest recorded at any length.

> . . . And I laugh to see how many have ere now drawn maps (*periodos*) of the world, not one of them showing the matter reasonably; for they draw the world as round as if fashioned by compasses, encircled by the river of Ocean, and Asia and Europe of a like bigness. For myself, I will in a few words show the extent of the two, and how each should be drawn.[39]

The objections of Herodotus were directed against the worlds of Homer, Anaximander, and Hecataeus which presumed a world-encircling ocean and a circular landmass. The objection was based, not on the fact that this was wrong in theory, but on the fact that it had never been observed. The conceptions were myth, and myth was alien to *istoria* (inquiry). Herodotus described only the known earth — the *oikoumene*; beyond the known world nothing was presumed but the unknown. Geography as distinct from cosmography retained this tradition. Knowledge of the shape of the earth and its position relative to heaven was necessary but incidental; geography henceforth was to be limited to the empirical study of the features of the *oikoumene*.

Aristotle, as cosmographer and geographer, made the same objections; but more explicitly and in character with the newer Hellenistic science.

> The way in which present maps (*periodous*) of the world are drawn is therefore absurd. For they represent the inhabited earth as circular, which is impossible both on factual and theoretical grounds . . . the facts known to us from journeys by sea and land . . . confirm the conclusion that its length is much greater than its breadth. For if one reckons up these voyages and journeys, so far as they are capable of yielding any accurate information, the distance from the Pillars of Heracles to India exceeds that from Aethiopia to Lake Maeotis and the farthest parts of Scythia by a ratio greater than that of 5 to 3. Yet we know the whole breadth of the habitable world up to the unhabitable regions which bound it, where habitation ceases on the one side because of the cold, on the other because of the heat; while beyond India and the Pillars of Heracles it is the ocean which severs the habitable

[36] *Herodotus*, Book II, 104.
[37] *Diodorus of Sicily*, Book III, 15–48.
[38] E. I. Robson, *Arrian: Indica*, Loeb Classical Library (London, 1929), Book VIII, 6.
[39] *Herodotus*, Book IV, 36.

land and prevents it forming a continuous belt round the globe.[40]

The concept of hot and cold uninhabited areas of the earth was a cosmographical not a geographical notion of describing features of the known world; but as Strabo later points out, cosmographical notions are antecedent and necessary to proper geographical description.

> Now let us see what Poseidonius has to say in his treatise on *Oceanus*. For in it he seems to deal mainly with geography treating it partly from the point of view of geography properly so called, and partly from a more mathematical point of view. . . . Now it is one of the things proper to geography to take as an hypothesis that the earth as a whole is spheroidal—just as we do in the case of the universe—and accept all the conclusions that follow this hypothesis, one of which is that the earth has five zones.[41]

Poseidonius, writing in the second century B.C., attributed the concept of the earth's five zones to Parmenides of the fifth century, and there is no reason to doubt that theories of a spherical earth under a spherical heaven, or heavens, were common philosophical conjectures of the sixth and fifth centuries B.C. Aristotle in the fourth century was a systematizer of such knowledge, depending primarily on his own observations and the synthesis advanced by Eudoxus in the early part of the century.[42] For Parmenides, for Eudoxus, and for Aristotle, the zones were celestial; that is, the grid of the celestial sphere(s) was "projected" on to the earth sphere thus identifying the arctic and tropic circles which bounded the frigid, temperate, and torrid zones. The arctic, tropic, and equatorial circles throughout classical study remained part of the celestial grid. A fragment of Polybius illustrates this geo-graphical methodology of location relative to extraterrestrial but natural process.

> Polybius the historian has composed a book with the title *On the parts of the globe under the Celestial Equator*, that is to say in the middle of the torrid zone. He says that the region is inhabited, and has a more temperate climate than that of those who inhabit the extremities of the torrid zone. On the one hand he cites the accounts given by those who have actually visited the region, and can testify to the fact, and on the other he argues from the nature of the sun's movements. For at the solstices the sun remains a long time near the tropic circles both in approaching them and receding from then, so that we actually see it stay in their neighbourhood for about forty days; for which reason the length of the day remains almost the same for about forty days. So owing to the length of its stay over the climates lying under the tropic circles, that region is burnt up and is uninhabitable owing to the excessive heat. But from the equinoctial circle or equator the sun recedes rapidly, so that the length of day rapidly increases or decreases after the equinoxes. It is reasonable then to suppose that the climates situated under the equator are more temperate, as the sun does not prolong his stay near the extreme point but rapidly recedes from it.[43]

Geo-graphical location by terrestrial natural processes have already been noted in the idiomatic literature by citations from Hesiod, Thales, Herodotus, and Hippocrates. Aristotle in the *Meteorologica* systematically discusses such earth processes as vulcanism, alluvial deposition, and temperature, wind, and water systems as differentiating areas. His students, Theophrastus and Dicaearchus, carried on the tradition in the analysis of floral and faunal distributions and mountain landforms.

> . . . the distinctions between the fruitless and fruit-bearing, flowering and flowerless, seem to be due to position and the climate of the district. And so too with the distinction between deciduous and evergreen. Thus they say that in the districts of Elephantine neither vines nor figs lose their leaves.
>
> . . . And in fact there seems to be some natural difference from the first in the case of wild and cultivated, seeing that some plants cannot live under the conditions of those grown in cultivated ground, and do not submit to cultivation at all, but deteriorate under it; . . .
>
> . . . If anyone were to plant our palm at Babylon, it is reasonable to expect that it would become fruitful and like the palms of that country. And so would it be with any other country which has fruits that are congenial to that particular locality; for the locality is more important than cultivation and tendance. A proof of this is the fact that things transplanted thence become unfruitful, and in some cases refuse to grow altogether.[44]

Dicaearchus is generally credited with extending the old Ionian, world line of orientation: Pillars of Hercules–Rhodes–Taurus Mountains – eastward along the mountain

[40] H. D. P. Lee, *Aristotle: Meteorologica*, Loeb Classical Library (London, 1952), Book II, 5.

[41] *The Geography of Strabo*, Book II, 2, 1–2; also Book I, 1, 20.

[42] *The Geography of Strabo*, Book IX, 1, 2; *Aristotle: Meteorologica*, Book II, 5, 16.

[43] *Polybius*, Book XXXIV, 1, Fragments from Geminus, *Elements of Astronomy*, C, 16; also *The Geography of Strabo*, Book II, 2, 2–3 and 3, 1–3.

[44] A. Hort, *Theophrastus: Enquiry into Plants*, Loeb Classical Library(London, 1916), Book I, 3, 5, Book II, 2, 7–8.

chain to the *Imaus* (Himalayas). This natural boundary became the main parallel for Eratosthenes' reformation of the world map (*pinaka*).[45] Eratosthenes' selection of natural features and settlements for determining the lines of parallel and the lines of meridian served also as the basic orientation for regionalizing the *oikoumene* into natural areas and conventional forms (*sphragides*). These natural sections became the *given* areas for chorographical description along with islands, peninsulas, ethnic areas, vegetation zones, etc.

> . . . And the account given by Eratosthenes is as follows: India is bounded on the north from Ariana to the eastern sea, by the extremities of the Taurus, which by the natives are severally called "Paropamisus," and "Emodus" and "Imaus" and other names, but by the Macedonians "Caucasus"; on the west by the Indus river; but the southern and eastern sides, which are much greater than the other two, extend out into the Atlantic sea, and thus the shape of the country (*choras*) becomes rhomboidal, each of the greater sides exceeding the opposite side by as much as three thousand stadia which is the same number of stadia by which the cape common to the eastern and southern coast extends equally farther out in either direction than the rest of the shore.[46]

While Eratosthenes is more justly famous for his almost perfect calculation of the circumference of the earth than for geographical description, that calculation, by definition, was a cosmographical rather than a geographical triumph. The most important mark of the classical discipline as a *science* was the writing of Eratosthenes' *Geographika* in the third century before Christ. It was the first recorded use of the word "geography" and set the direction of study for the next twenty centuries.[47] Eratosthenes' geography was, nonetheless, substantively primitive and crude. The new reformed map of the world still lacked an ordered grid of proportionately spaced parallels and meridians, and the concept of *klimata* was still ill-defined and noncomprehensive. The principle of "fixing" places relative to the inclination (*klima*) of the sun by gnomon was known to the Ionians and is claimed to have been systematized by Eudoxus; but such *klima* did not as yet define the parallels.[48] The *klimata* of Eratosthenes were actually narrow bands immediately spanning his irregularly placed, terrestrially determined parallels. They were therefore non-contiguous and were located by the parallels rather than by the gnomon.

It was left to Hipparchus and Poseidonius in the next century to construct the earth grid and the climatic zones as Strabo, Pliny, Ptolemy, and modern geographers know them. Hipparchus laid out the present earth grid of latitude and longitude and Poseidonius is credited with making the *klimata* contiguous belts bounded by the new earth grid. The possibility of determining parallels of latitude from the observation of similar climatic conditions was recognized and *vice versa*. The importance of this analytic method is that it made possible the integration of past chorographic and topographic description into the new world map. Qualitative environmental descriptions could now be quantified, i.e. given latitude, and gnomonic site calculations could be qualitatively described by analogy. The full fruition of this procedure comes in Ptolemy's *Geographike Uphegesis*. Very few site readings by gnomon were available even by the time of Ptolemy and it is fairly certain that practically all the latitude and longitude readings of the *Uphegesis* are readings from a map which was constructed from a collation of chorographic and topographic descriptions dating back from Marinus to Homer.[49]

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[45] For Dicaearchus see G. Sarton, *A History of Science*, Vol. I, p. 527, quotation from Agathemerus (400 A.D.?). For Eratosthenes see *The Geography of Strabo*, Book II, 1, 1–2.

[46] *The Geography of Strabo*, Book XV, 1, 11. For comment see A. Thalamas, *Etude Bibliographique de la Géographie d'Eratosthène* and *La Géographie d'Eratosthène* (Versailles, 1921).

[47] The word geography occurs in the pseudo-Aristotle *Peri Kosmou* in the form *geographesontes*, but the date is probably first century A.D. See D. J. Furley, *Aristotle: On the Cosmos*, Loeb Classical Library (London, 1955), Section 3, 393, 21.

[48] *The Geography of Strabo*, Book IX, 1, 2; Book II, 5, 34; 5, 16; 5, 1; 5, 4; 5, 10; 1, 35; 1, 20. *Klimata* is loosely used in the sense of direction also: *Strabo*, Book I, 2, 20 and Book X, 2, 12.

[49] *The Geography of Strabo*, Book I, 4, 1–5; Book II, 2, 1–3; 3, 1–2; 5, 34–43. See commentary by D. R. Dicks, "The Klimata in Greek Geography," *The Classical Quarterly*, Vol. V (July–October, 1955), pp. 248–255, and "Strabo and the Klimata," *The Classical Quarterly*, Vol. VI (July–October, 1956), pp. 243–247. On the general problem see: D .R. Dicks, *The Geographical Fragments of Hipparchus* (London, 1960); A. Diller, "Geographical Latitudes in Eratosthenes, Hipparchus and Posidonius," *Klio*, Vol. XXVII (1934), pp. 258–269; A. Diller, "The Parallels on the Ptolemaic Maps," *Isis*, Vol. XXXIII, No. 87 (March, 1941), pp. 4–7, and "The Ancient Measurements of

THE SYNTHESIS OF STRABO

The developments from Eratosthenes to the time of Augustus are best summarized in the fragments and testimonies preserved in Strabo. The seventeen books of his *Geographia* contain the major classical synthesis of geography, chorography, and topography. We can logically reconstruct geographical studies of the pre-Christian era from other sources, but our knowledge of how it was done is derived largely from Strabo. In this querulous, garrulous Pontic Cappadocian we have half the library of classical geography, and his view of its nature, purpose, and practice remains the most authoritative statement ever written.

That view is quite easily summarized because it is essentially philosophic. Geography, chorography, and topography are a disciplinary whole. There is no doubt that they are differing methods of description, limited as to perspective, but asking essentially the same root question — "where"? Inasmuch as they ask the question for differing reasons they are specialized studies and are so distinguished in classical literature; yet they remain a single discipline because they describe but the one thing—place.

Strabo was a Stoic and so was not interested in the "causes" of things as was Aristotle. He was a describer of things, not an analyst, and sometimes seems to lack intellectual purpose and direction. Despite these convictions his subject overwhelmed him—Strabo could not escape the logic of what he was doing. In describing the "where of things" he was bound to answer by searching for order and thereby creating a relational framework. The recognition of a relational framework can involve merely description. (The necessary existence of an underlying causal nexus can remain a moot question, unexpressed.) So it was for Strabo who admits no search for cause.

> . . . in Poseidonius there is much inquiry into causes and much imitating of Aristotle—precisely what our school avoids, on account of the obscurity of the causes.[50]

Acceptance of the description of relation, not the search for cause, is sufficient for understanding Strabo and classical geography. Denying design and embracing contingency does not subvert the necessary description of place. Place is not determined, but is a condition of existence—it can not be written off as of no account.

> . . . a distribution of animals, plants, and climates as exists is not the result of design—just as the differences of race, or of language, are not either—but rather of accident and chance. And again, as regards the various arts and faculties and institutions of mankind, most of them, when once men have made a beginning, flourish in any latitude whatsoever and in certain instances even in spite of the latitude; so that some local characteristics of a people come by nature, others by training and habit.[51]

Strabo, thus, comes to the point. What is to be described and how does one *do* a description? His limitations are those of all classical geographers, "who would fix positions for the whole of the inhabited world."

> . . . my first and most important concern, both for the purposes of science and for the needs of the state, is this—to try to give, in the simplest possible way, the shape and size of that part of the earth which falls within our map, indicating at the same time what the nature of that part is and what portion it is of the whole earth; for this is the task proper of the geographer. But to give an accurate account of the whole earth and of the whole "spinning-whorl" of the zone of which I was speaking is the function of another science.[52]

Strabo would write for the needs of the state but he would caution against recording "the diversified political divisions which are made by the rulers," for they are transitory. Rather, the geographer should tell of "the physical and ethnic distributions which have been made" and "not only of the facts of the present, but also sometimes of the facts of the past." In reality the needs of the state are similar to those of the philosopher.

> . . . the geographer does not write for the native of any particular place, nor yet does he write for the man of affairs of the kind who has paid no attention to the mathematical sciences properly so-called; nor, to be sure, does he write for the harvest-hand or the ditch-digger, but for the man who can be persuaded that the earth as a whole is such as the mathematicians represent it to be, and also

the Earth," *Isis*, Vol. XL: 119 (February, 1949), pp. 6–9; O. Neugebauer, "On Some Astronomical Papyri and Related Problems of Ancient Geography," *Transactions* of the American Philosophical Society, N.S. Vol. 32 (1943), pp. 251–263; A. D. Nock, "Posidonius," *The Journal of Roman Studies*, Vol. XLIX (1959), pp. 1–15.

[50] *The Geography of Strabo*, Book II, 3, 8.
[51] *The Geography of Strabo*, Book II, 3, 7.
[52] *The Geography of Strabo*, Book II, 5, 1; 5, 13.

all that relates to such an hypothesis. And the geographer urges upon his students that they first master those principles and then consider the subsequent problems; for he declares, he will speak only of the results which follow from these principles; and hence his students will the more unerringly make the application of his teachings if they listen as mathematicians; but he refuses to teach geography to persons not thus qualified.[53]

The synthesis in geography of the chorographic and topographic specialties and their dependency in turn upon geography is never questioned. For Strabo the inter-relation verges on a law of nature: "in the study of geography we inquire not merely into the shapes and dimensions of countries, but also, as I have said, into their positions with reference to each other." The parts of the *oikoumene* to be described are like parts of the body, that is, they are natural units defined by natural boundaries. Recognition of what is given in nature is the first prerequisite of geography.

> . . . in the case of geography, we must indeed make sections of the parts when we go over them in detail, but we must imitate the limb-by-limb amputations rather than the haphazard amputations. For only thus it is possible to take off the member that is significant and well-defined, the only kind of member that the geographer has any use for. Now a country is well-defined when it is possible to define it by rivers or mountains or sea; and also by a tribe or tribes, by a size of such and such proportions, and by shape where this is possible. But in every case, in lieu of a geometrical definition, a simple and roughly outlined definition is sufficient.[54]

It must be emphasized that what is given in nature is only the first prerequisite. That is where one begins. There is, beside the chance of nature, the attributes of place resulting from human design.

> . . . since different places exhibit different good and bad attributes, as also the advantages and inconveniences that result therefrom, some due to nature and others resulting from human design, the geographer should mention those that are due to nature; for they are permanent, whereas the adventitious attributes undergo changes. And also of the latter attributes he should indicate such as can persist for a long time, or else such as can not persist for long and yet somehow possess a certain distinction and fame, which, by enduring to late times, make a work of man, even when it no longer exists, a kind of natural attribute of a place; . . .[55]

[53] *The Geography of Strabo*, Book IV, 1, 1; Book VI, 1, 2; Book II, 5, 1; Book I, 1, 1.
[54] *The Geography of Strabo*, Book II, 5, 18; 1, 30.
[55] *The Geography of Strabo*, Book II, 5, 17.

Herein lies the essence of Strabo — the search for "a kind of natural attribute of a place." He admits to no philosophic determinism, whether of physical or cultural process. Strabo rather is searching for the persistent effect. In seeking out the most stable configuration of human behavior he allies it with the more stable patterns of nature. Culture, thus, becomes part of the *oikoumenic* natural process and undifferentiated from the other general features to be comprehensively described in geography.

The work of Strabo is in many ways the logical culmination of classical geography. Unlike the later studies of Pliny and Ptolemy, which are selective specializations, Strabo's *Geographia* is a full corpus of all that came before. The integration of geography, chorography, and topography in one literary whole is, as far as we know, unique in the classical period. What seemed in the past to be either divergent or self-contained trends are brought into comprehension around the central thesis of location. Strabo's signal contribution is in the philosophical awareness of the importance of the concept of place as an integrating theme in all three studies. That is not to say that he viewed the three types of description as equal, for he did not, but neither did he dissolve the three perspectives into one undifferentiated whole.[56]

For Strabo and for classical geography geographical description was primarily the observation, analysis, and explanation of "where." There were natural locations, natural boundaries, and natural regions. "Why" was a legitimate question although not often answered. Chorography was the description of a region. Topography was the description of a distribution. Geography, chorography, and topography were the "sciences" of relationship. The analysis of process, cultural and natural, was

[56] Modern attempts to create an overriding integrating concept for geographical studies are in no sense a logical outgrowth of classical studies. Especially divorced from the classical development of the discipline is the modern "chorologic" concept. As initiated by F. Marthe this is entirely a nineteenth century neologism despite its classic rubric and rationale, and in its later development it is "mainstream" only in the parochial sense of modern positivistic science. See F. Marthe, "Begriff, Ziel und Methode der Geographie und v. Richthofen's China, Bd. I," *Zeitschrift der Gesellschaft für Erdkunde zu Berlin*, 12 (1877), pp. 422–478.

the objective of description, and genesis was its mode of classification.

APPENDIX OF SOURCES

A Source Book in Greek Science. R. Cohen and I. E. Drabkin, editors (New York, 1948), pp. 162–165.

Wherein geography differs from chorography.

Geography is the representation, by a map, of the portion of the earth known to us, together with its general features. Geography differs from chorography in that chorography concerns itself exclusively with particular regions and describes each separately, representing practically everything of the lands in question, even the smallest details, such as harbors, villages, districts, streams branching from the principal rivers, and the like. It is the task of geography, on the other hand, to present the known world as one and continuous, to describe its nature and position, and to include only those things that would be contained in more comprehensive and general descriptions, such as gulfs, large cities and nations, the more important rivers, in short the more significant instances of each type.

The purpose of chorography is the description of the individual parts, as if one were to draw merely an ear or an eye; but the purpose of geography is to gain a view of the whole, as, for example, when one draws the whole head.

Now in the case of the drawings just referred to, the principal parts are of necessity fitted in first, and must be properly proportioned, when seen from a suitable distance, to the spaces on the surface used for the drawing (whether the drawing be of an entire object or of only a part), in order that the representation may be perceived as a whole. It is consequently both reasonable and proper that chorography should represent the smaller particular details and geography the regions themselves with the general features that belong to them. For the principal features of the inhabited earth and those most readily fitted in on the proper scale are the various regions themselves in their proper location; while the principal features of these regions are the peculiar details of the land in question.

Again, chorography deals, for the most part, with the nature rather than with the size of the lands. It has regard everywhere for securing a likeness but not, to the same extent, for determining relative positions. Geography, on the other hand, is concerned with quantitative rather than with qualitative matters, since it has regard in every case for the correct proportion of distances, but only in the case of the more general features does it concern itself with securing a likeness, and then only with respect to configuration.

Therefore chorography has need of topography, and no one can be a chorographer unless he is also skilled in drawing. But geography has no such absolute need of topography, for by using mere lines and annotations it shows positions and general outlines. For this reason, while chorography does not require the mathematical method, in geography this method plays the chief part.

For geography must first consider the form of the whole earth as well as its size and its position with reference to the heavens, so that it may be able to tell the size and nature of the known portion of the earth and under what parallel circles of the celestial sphere each place lies. From this it will be possible to learn the length of nights and days, the fixed stars that are overhead and those that at all times are above or below the horizons, as well as all other information that we include in an account of habitable regions.

These are studies that form a part of the most sublime and beautiful theoretic science, for it is with the aid of mathematics that they reveal to man's understanding the heaven itself in its true nature (for we can observe it as it rotates about us); while they represent the earth through a model, since the real earth, which is so great and does not surround us, cannot be traversed in its entirety or in its individual parts by the same men.

The foundations of geography.

The above account should suffice as a general outline of the purpose of the geographer and wherein he differs from the chorographer.

Since we have now undertaken to map our inhabited world in such a way as to approximate the proportions of the real world as closely as possible, we think that we should explain beforehand that in this procedure the descriptions given by travelers are of the highest importance. For we gain our greatest knowledge from the reports of those travelers through the various regions who have theoretic understanding of geography. Again, their observations and reports may be based either on geometrical or astronomical measurement. Now geometry indicates the relative positions of places by simple measurement of distances while astronomy uses observational data obtained with astrolabes and sundials. The astronomical method is self sufficient and more accurate, but the geometrical method is rougher and requires the astronomical to support it.

Now since in either case it is necessary to determine in what direction the line joining two given places lies (for it is necessary to know not merely the distance between the places but also the direction, whether it be, e.g., to the north or the east or some line intermediate between them), it is impossible to perform this investigation accurately without observation by means of the aforesaid instruments. For with their help the position of the meridian may be obtained at any time and place, and, as a consequence, the direction of distances traversed.

Geography of Claudius Ptolemy. B. L. Stevenson, editor and translator, introduction by J. Fischer (New York Public Library, 1932), Book One, Chapters I and II.

In What Geography Differs from Chorography.

Geography is a representation in picture of the whole known world together with the phenomena which are contained therein.

It differs from Chorography in that Chorography, selecting certain places from the whole, treats

more fully the particulars of each by themselves—even dealing with the smallest conceivable localities, such as harbors, farms, villages, river courses, and such like.

It is the prerogative of Geography to show the known habitable earth as a unit in itself, how it is situated and what is its nature; and it deals with those features likely to be mentioned in a general description of the earth, such as the larger towns and the great cities, the mountain ranges and the principal rivers. Besides these it treats only of features worthy of special note on account of their beauty.

The end of Chorography is to deal separately with a part of the whole, as if one were to paint only the eye or the ear by itself. The task of Geography is to survey the whole in its just proportions, as one would the entire head. For as in an entire painting we must first put in the larger features, and afterward those detailed features which portraits and pictures may require, giving them proportion in relation to one another so that their correct measure apart can be seen by measuring them, to note whether they form the whole or a part of the picture. Accordingly therefore it is not unworthy of Chorography, or out of its province, to describe the smallest details of places, while Geography deals only with regions and their general features.

The habitable parts of the earth should be noted rather than the parts which are of equal size, especially the provinces or regions and their divisions, the difference between these being rather the more important. Chorography is most concerned with what kind of places those are which it describes, not how large they are in extent. Its concern is to paint a true likeness, and not merely to give exact position and size. Geography looks at the position rather than the quality, noting the relation of distances everywhere, and emulating the art of painting only in some of its major descriptions. Chorography needs an artist, and no one presents it rightly unless he is an artist. Geography does not call for the same requirements, as anyone, by means of lines and plain notations can fix positions and draw general outlines. Moreover Chorography does not have need of mathematics, which is an important part of Geography. In Geography one must contemplate the extent of the entire earth, as well as its shape, and its position under the heavens, in order that one may rightly state what are the peculiarities and proportions of the part with which one is dealing, and under what parallel of the celestial sphere it is located, for so one will be able to discuss the length of its days and nights, the stars which are fixed overhead, the stars which move above the horizon, and the stars which never rise above the horizon at all; in short all things having regard to our earthly habitation.

It is the great and exquisite accomplishment of mathematics to show all these things to the human intelligence so that the sky, too, having a representation of its own character, which, although it cannot be seen moving around us, yet we can look upon it by means of an image as we look upon the earth itself, for the earth being real and very large, and neither wholly nor in part moving around us, yet it can be mapped by the same means as is the sky.

What presuppositions are to be made use of in Geography.

What Geography aims at, and wherein it differs from Chorography, we have definitely shown in our preceding Chapter. But now as we propose to describe our habitable earth, and in order that the description may correspond as far as possible with the earth itself, we consider it fitting at the outset to put forth that which is the first essential, namely a reference to the history of travel, and to the great store of knowledge obtained from the reports of those who have diligently explained certain regions; whatever concerns either the measurement of the earth geometrically or the observation of the phenomena of fixed localities; whatever relates to the measurement of the earth that can be tested by pure distance calculation to determine how far apart places are situated; and whatever relations to fixed positions can be tested by meteorological instruments for recording shadows. This last is a certain method, and is in no respect doubtful. The other method is less perfect and needs other support, since first of all it is necessary to know in determining the distance between two places, in what direction each place lies from the other; to know how far this place is distant from that, we must also know under what part of the sky each is located, that is, whether each extends toward the north, or, so to speak, toward the rising of the sun (the east) or in some other particular direction.

KANT'S GESAMMELTE SCHRIFTEN, Band IX, Physische Geographie, Physische Erdbeschreibung, Einleitung 3 (Berlin und Leipzig, 1923), p. 159.

Aber zu merken ist dies: Jede fremde Erfahrung theilt sich uns mit, entweder als Erzählung, oder als Beschreibung. Die estere ist eine Geschichte, die andere eine Geographie. Die Beschreibung eines einzelnen Ortes der Erde heisst Topographie. –Ferner Chorographie, d.i. Beschreibung einer Gegend und ihrer Eigenthümlichkeiten. –Orographie, Beschreibung dieser oder jener Gebirge. –Hydrographie, Beschreibung der Gewässer.

Anmerkung. Es ist hier nämlich von Weltkenntniss die Rede und sonach auch von einer Beschreibung der ganzen Erde. Der Name Geographie wird hier also in keiner andern als der gewöhnlichen Bedeutung genommen.

GÉOGRAPHIE GÉNÉRALE. B. Varenius, Revue par Isaac Newton, augmentée par Jacques Jurin (Paris, 1755), pp. 2–4 and 8, Tome Premier.

Définition de la Géographie.

La Géographie est une partie des Mathématiques mixtes, où on explique l'état de laxterre & de ses parties, qui regarde la quantité, sçavoir sa figure, sa position, sa grandeur & son mouvement, avec les apparences célestes, etc.

Il y a des Auteurs qui prenant le mot *Géographie* dans un sens trop resserré, la définissent une description nue des différens pays. D'autres lui

donnant trop d'étendue, voudroient y comprendra la constitution politique des Etats. Ceux qui en usent ainsi, sont excusables en ce qu'ils ne le font que pour encourager & amuser agréablement le Lecteur. En effet il n'apporteroit qu'une foible attention à une énumération & à une description simple des pays, si on n'y joignoit quelque connoissance des moeurs & des coutumes de leurs habitans.

Division de la Géographie.

On distingue la Géographie en universelle & particuliere. Golnitz dit qu'on doit expliquer la Géographie extérieurement & intérieurement; mais cette façon de parler est impropre & mal choisie; il nous paroit plus juste de la diviser en universelle & particuliere. Nous entendons par Géographie *universelle*, celle qui considere toute la terre en général, & en explique les propriétés, sans entrer dans le detail particulier des pays. La Géographie *particuliere* décrit la situation & la constitution de chaque pays séparement; & on la subdivise en *chorographie* qui décrit des pays d'une étendue considerable & *topographie* qui n'embrasse qu'un lieu ou une petite portion de terrein.

Nous traiterons dans cet ouvrage de la Géographie *universelle*, que l'on peut diviser en trois parties; sçavoir la partie *absolue*, ou Géographie proprement dite; la partie *relative*; & la partie *comparative*. Nous expliquerons dans la partie *absolue* ce qui regarde le corps du globe en lui-même, ses parties & leurs propriétés particulieres, telle que sa figure, sa grandeur, son mouvement, ses terres, ses mers, ses rivieres, etc. La partie *relative* comprendra les phénomenes & les accidens qui arrivent par l'influence des causes célestes. Enfin la partie *comparative* contiendra l'explication des propriétés qui résultent de la comparaison des diverses parties de la terre.

Proprietes de la Géographie.

. . . Telles sont les trois especes d'observations qu'il faut faire dans la Géographie particuliere, & quoique celles de la derniere espece semblent n'être qu'improprement du ressort de cette science, on est pourtant obligé de les y admettre tant pour se conformer à la coutume, que pour l'instruction du Lecteur.

Mais dans la Géographie universelle, qui est le sujet de cet ouvrage, on examinera d'abord la division *absolue* de la terre & la constitution de ses parties; ensuite on expliquera dans la partie *relative* les phénomenes célestes en general, qui doivent être appliqués a leurs pays respectifs; enfin on fera dans la partie *comparative* les observations qui naissent de la comparaison des phénomenes d'un lieu à un autre.

COSMOGRAPHIA. Petri Apiani, per Gemam Frisium... (Antverpiae, 1574), Prima Pars.

Geographia quid.

Geographia (vt Vernerus in paraphrasi ait) est telluris ipsius praecipuarum ac cognitarum partium quatenus ex eis totus cognitusque terrarum obis constituitur, & insigniorum quorumlibet, quae huiusmodi telluris partibus cohaerent, formula quaedam ac picturae imitatio. Et a Cosmographia differt, quia terram distinguit per montes, & maria aliaque insigniora nulla adhibita circulorum ratione. Lisque maxime prodest, qui adamussim rerum gestarum & fabularum peritiam habere disiderant. Pictura enim feu picturae imitatio, ordinem situmque locorum ad memoriam facillimaè ducit. Consummatio itaque & finis Geographiae totius Orbis terrarum constat intuitu, illorum imitatione, qui integram capitis similitudinem idoneis picturis effingunt.

Chorographia quid.

Chorographia autem (Vernero dicente) quae & Topographia dicitur, partialia quaedam loca seorsum & absolutè considerat, absque eorum ad seinuicem & ad vniuersum telluris ambitum comparatione. Omnia siquiden, ac ferè minima in eis contenta tradit & prosequitur: velut portus, villas, populos, riuulorum quoque decursus, & quaecunque alia illis finitima, vt sunt aedificia, domus, turres, moenia, etc. Finis verò eiusdem in effigienda partilius loci similitudine consummabitur: veluti pictor aliquis aurem tantùm aut oculum designaret depingeretque.

A CORRELATION AND REGRESSION ANALYSIS APPLIED TO RURAL FARM POPULATION DENSITIES IN THE GREAT PLAINS[1]

ARTHUR H. ROBINSON, JAMES B. LINDBERG, LEONARD W. BRINKMAN
University of Wisconsin

INTRODUCTION

THE geographer's interest in modern descriptive and analytical statistical methods is growing, especially with respect to their potential usefulness in regional analysis. Correlation techniques, including multiple correlation and regression, are particularly suited to aiding the geographer in his traditional study of the areal variations of related phenomena, since the variables always exist in complex interconnection.[2] One may properly employ these statistical-cartographic techniques after he has established tentative descriptive hypotheses regarding the mutuality that may exist among the distributions of an area, inferred through the study of individual maps and other sorts of data. Coefficients of correlation and related indices provide general quantitative statements of the degree to which each hypothesis is valid. These may be sharpened through the use of partial correlation techniques which statistically hold constant designated variables while investigating any two. Regression mapping portrays the areal distribution of the degree of correspondence, shows the locations of departures from the average relationship, and provides a basis for formulating additional hypotheses.

In this paper attention is focused on the areal variations in the density of the 1950 rural farm population in the Great Plains. Several distinct phenomena are believed to vary in a reciprocal fashion with rural farm population density; these interrelationships are examined, and statements are made about the closeness of correspondences among them. Average annual precipitation, distance to urban centers, and percent of cropland are several of the factors that are considered to be important "determinants" in the variations from place to place of farm population density. But in the Great Plains just how significant are they individually and relative to one another? If there is a general pattern of covariation, where are the areas that depart from it? Such questions, in an areal setting, form the core of much of modern geographical study, and the techniques that are presented here as partial answers are believed to have wide applicability.

This paper is also concerned with several questions of statistical-cartographic methodology which are as yet only partially solved. Among these are: (1) the question of what sampling method to use when a map of uniform validity is desired as opposed to a single summary measure; (2) the problems that arise when one wishes to employ both point data and unit-area data in a statistical computation; (3) the problem occasioned by the unequal sizes of unit areas; and (4) the question of how best to map departures from certain mean relationships (regression residuals).[3]

If modern statistical tools that are appropriate to geographical analysis are to find their way into the research repertoire of geographers, they must be subjected to the rigors of repeated testing in a variety of geographical contexts. It is only through such testing that the usefulness, and the limitations, of these tools can be understood.

[1] Portions of this study were supported by the Graduate School Research Committee, University of Wisconsin.

[2] As demonstrated, for example, in: Harold H. McCarty, J. C. Hook, and D. S. Knos, *The Measurement of Association in Industrial Geography* (State University of Iowa, Iowa City, 1956); George W. Hartman and J. C. Hook, "Substandard Urban Housing in the United States, a Quantitative Analysis," *Economic Geography*, Vol. 32(1956), pp. 95–114; E. J. Taaffe, "Trends in Airline Passenger Traffic: a Geographic Case Study," *Annals*, Association of American Geographers, Vol. 49(1959), pp. 393–408.

[3] Since the research reported in this paper was completed a good technical summary of the use of residuals from linear regression has appeared: Edwin N. Thomas, *Maps of Residuals from Regression: Their Characteristics and Uses in Geographic Research*, No. 2, Department of Geography, State University of Iowa, Iowa City, 1960. Although carried forward without what would have been the considerable aid of Thomas' monograph, this paper may be considered as an illustration of some of the methods he treated. The technically interested reader should refer to the monograph for a fuller description of the methods.

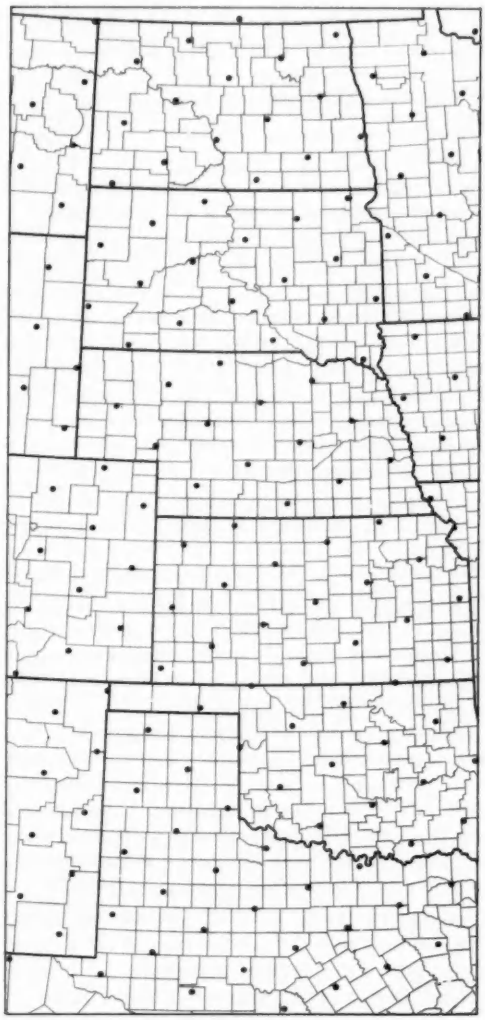

FIG. 1. The area dealt with in the study. The pattern of dots shows the arrangement of control points used for computation and mapping purposes.

THE AREA AND THE HYPOTHESES

The focus of interest is on the area in the United States generally designated as the Great Plains and its marginal areas extending from the Canadian border to central Texas. It was arbitrarily defined by centering a rectangle on the intersection of the 40th parallel and the 100th meridian (Fig. 1). This includes more than 600 counties. A majority of the population is dependent directly or indirectly on agriculture and the census group "closest to the land" is the rural farm population. The basic question, given the regional variations of rural farm population density in this region, is simply: how do other factors that hypothetically may be significant vary in interrelationship with the rural farm population density?[4]

The pattern of farm population density in any area is naturally the composite result of numerous physical, cultural, historical, and economic "influences." To understand their areal interrelationship completely is out of the question, but one can sort out what seem likely to be the dominant factors in a logical relationship, and then examine their relative significance. This is what the authors attempt to do.

The first hypothesis subjected to analysis is that the variations from place to place in the density of rural farm population are directly related to the variations in average annual precipitation. Such an hypothesis would probably bring forth few dissenting voices,[5] but unanimity as to the relative importance of annual precipitation as compared to other variables or the closeness of the relationship over the entire area is less certain. In order to study this hypothesis, in the statistical-cartographic sense, the population density is designated the dependent variable and average annual precipitation, the independent variable.[6]

[4] The pattern of rural farm population density is defined as that which results from dividing the rural farm population of each county (as given in the 1950 Census) by the total area of the county. The authors recognize the severe limitations of any simple "population category" as given by a Census definition when a general definition is applied to a particular area, especially one characterized by high mobility and economic complexity. To attempt to correct the census category would be quite another, and larger, study.

[5] Robinson and Bryson obtained a correlation coefficient of +.83 for Nebraska in "A Method for Describing Quantitatively the Correspondence of Geographical Distributions," *Annals*, Association of American Geographers, Vol. 47(1957), pp. 379–391.

[6] Average annual precipitation for the period 1940–49 was computed for 134 stations in the area with which this paper is concerned. The ten-year period was selected because it was felt that although farm population may change in response to periodic fluctuations in precipitation, under present-day social and economic conditions in the United States a period of several years would be necessary for these changes to be felt.

The second hypothesis, scrutinized with the aid of correlation methods, is that rural farm population density varies inversely with distance from an urban center. Brunner and Kolb have demonstrated the validity of this general statement for the United States as a whole with respect to cities having over 20,000 inhabitants.[7] The independent variable used herein is the straight-line mileage from each population density control point to the nearest urban center that had 10,000 people or more within its municipal boundaries in 1950.[8]

The third hypothesis examined is that differences in rural farm population density vary directly with the potential quality of the land for growing crops. An independent variable for this purpose would be some quantitative aspect of the potential quality of the land, such as the soil fertility or the percentage of land in gentle slope. Unfortunately, however, quantitative measures of soil productivity or fertility are unavailable, and moreover, the topographic map coverage of the Great Plains is incomplete and much of it is unreliable. Consequently the independent variable selected is the percentage of cropland in the total land area of each county.[9] The third hypothesis must then be modified and stated: rural farm population density varies directly with the percentage of cropland in the total land area. This measure reflects some of the wanted characteristics, but it is also influenced by such factors as market accessibility, or the susceptibility of the land to irrigation. As is shown later, however, some of these interconnections can be isolated.

PROBLEMS OF DATA PREPARATION

The data used to characterize the four variables described in the foregoing section required special types of processing for two reasons: (1) because the results of the analyses were desired in a form suitable for geographical description and analysis, and (2) the more than 600 counties which make up the study area are arranged in a generally rectangular pattern as well as having a variety of sizes and shapes. These aims and facts conspire to create several problems that will, no doubt, often arise when one uses statistical techniques in a geographical study in which a major objective is to map variations from place to place.

Correlation and regression analysis of an area can be undertaken in a variety of ways depending upon the manner in which the data occur and the aims of the researcher. Some of the data used herein apply to points and some to unit areas. To attempt to treat the data as a population of unit areas would require conversion of the point data to unit area data and would have two major disadvantages: the variation in unit area sizes would necessitate weighting,[10] and the rectangular pattern would create interpolation problems in mapping.[11] Random sampling would not necessarily provide equal representation for all parts of the study area, and the results of the statistical analyses could not, therefore, properly be used to map variations within the area, although they would yield useful summary values for the area as a whole.

In order to bypass these several difficulties and to obtain cartographic advantages, the county population data were transformed to values for uniform hexagonal unit areas, the centers of which serve as data control points. The point data were derived (by measurement and interpolation) for these hexagonally arranged control points. Thus the rural farm population and the percent of cropland data are used in their entirety, so to speak, but the unit areas are merely rearranged in compilation to provide more adequate mapping control. On the other hand the precipitation data and the distance-to-urban-center data are sam-

[7] E. deS. Brunner and J. H. Kolb, *Rural Social Trends* (New York: McGraw-Hill, 1933), pp. 111–143.

[8] Several other ways of expressing this same idea in commensurable terms could have been used. For example, a different limiting city size could have been selected or measures of distance such as travel time or paved road distance could have been employed.

[9] Total cropland is the summation of the following Census items for each county: cropland harvested, cropland now used for pasture, land from which hay was harvested, summer fallow, land in soil improvement, land on which crops failed. A detailed definition and the figures used are contained in *U. S. Census of Agriculture*, 1950, Vol. I, Part I.

[10] Arthur H. Robinson, "The Necessity of Weighting Values in Correlation Analysis of Areal Data," *Annals*, Association of American Geographers, Vol. 46(1956), pp. 233–236, presents an illustration of this problem and one method of solving it.

[11] J. Ross Mackay, "The Alternative Choice in Isopleth Interpolation," *The Professional Geographer*, Vol. 5, No. 4 (July 1953), pp. 2–4.

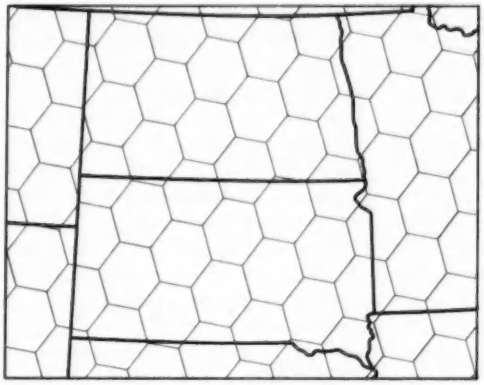

FIG. 2. A portion of the hexagonal grid used for data compilation and processing.

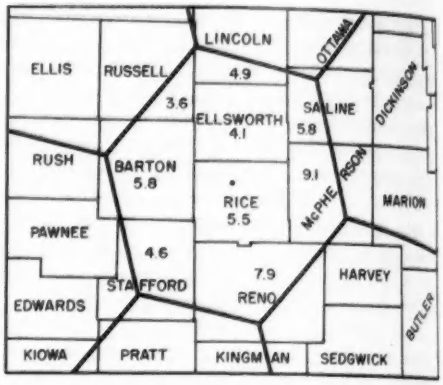

FIG. 3. A portion of the hexagonal grid in central Kansas showing how county rural farm population density data were converted to unit area values for the hexagons. The numbers are the densities and the data for each hexagon were processed as follows:

County	Density	×	Estimated Portion of hexagon	=	Product
Rice	5.5		.17		.93
Ellsworth	4.1		.17		.70
Reno	7.9		.16		1.26
Barton	5.8		.13		.75
Stafford	4.6		.12		.55
McPherson	9.1		.12		1.09
Saline	5.8		.06		.35
Lincoln	4.9		.04		.20
Russell	3.6		.03		.11
			1.00		5.94

The resultant density used for the hexagon centered on Rice County is 5.94 persons per square mile.

pled by obtaining values that refer to the centers of the hexagons.

A hexagon is the most economical geometric figure with which to subdivide an area without overlap. The average distance from the central point of a hexagon to its perimeter is less than in a rhombic, square, or rectangular figure of an equal area. Hence an hexagonal control point value is less influenced by extreme portions of the area it represents, and therefore, theoretically, should be more representative. Furthermore, the center points of adjacent hexagons form the apexes of triangles; consequently, whatever the values at adjacent control points there is only one place between them that an isarithm of intermediate value can be located, thus eliminating the problem of alternative choice.[12] These advantages were obtained by (1) randomly orienting an hexagonal overlay from a randomly chosen point of origin, (2) obtaining both point values for the centers and deriving average unit area values for the sections covered by each hexagon, and (3) assuming the center of the hexagon as a control point for all mapping purposes. The selection of the size, i.e. the number, of hexagons to employ is important since this establishes the number of sets of data available for correlation analysis and the number of control points for constructing the isarithmic maps. The overlay illustrated in Figure 2 yields 161 hexagons. This number provides adequate control for both purposes.[13]

The method of obtaining the control point values varied according to whether the data were functions of area or points. For those that were functions of area (population density and percent of cropland) resultants were obtained as follows: the county averages were

[12] The reader will note that the hexagons illustrated in Figures 2 and 3, although uniform, are not equilateral. A slight departure from regularity was made in drawing the hexagonal grid, but since the most important attribute of the grid is that the centers of the figures form a pattern of triangles, the irregularity was not corrected.

[13] Although tests of significance are common, their application in an essentially descriptive study is not usually explicitly treated. Putting it simply: if two distributions are quite unrelated it is nevertheless likely that purely random fluctuations in the two may produce a correlation coefficient other than 0. In this study the probability of such a circumstance producing a value of r that departs far from 0 is very low since n (the number of data points) is relatively large (161). For example, when $n = 150$, an r over .20 is likely to occur accidentally only about once in 100 times.

assumed to exist uniformly throughout the county; the value for each county that was included within an hexagon was multiplied by the fraction of the hexagon that the county occupied; and the products were then summed to provide the resultant (see Fig. 3). A different procedure was used to obtain precipitation and distance data. Rainfall data exist only at the locations of the recording stations; consequently values at the centers of hexagons were interpolated from these stations. Straight-line distance between the center of a hexagon and the nearest city of over 10,000 people is also a function of points, and it was measured directly from base maps.

THE CORRELATION ANALYSIS

Three kinds of correlation coefficients for the entire study area were obtained from the four sets of data: (1) coefficients of simple correlation (r), which describe the degree to which two of the variables are associated; (2) coefficients of partial correlation, which also describe the association between two of the variables, but do so by eliminating the effect of one or more other variables which may be interrelated; (3) coefficients of multiple correlation (R), which describe the degree to which three or more of the variables are associated. These are tabulated in Table 1. These kinds of measures of association are summary values, that is, they apply to the entire area under study, and they cannot be used for mapping internal variation of the degree of association. Their role is merely to describe the degree of spatial correspondence among the areal variations of the variables as measures of the validity of hypotheses constructed for the area as a whole. Coefficients of +1.00 and –1.00 indicate, respectively, perfect direct and inverse correspondence of variations from place to place.

The coefficient of correlation between rural farm population density and average annual precipitation, $r_{12} = +.78$, confirms the general hypothesis that variations in rural farm population density in the Great Plains are directly and closely associated linearly with variations in average annual precipitation. In a similar manner the simple coefficients between rural farm population density and the other two variables (distance from a city of 10,000 and percentage of cropland in the total land area of the county) provide descriptions of the degree to which variations of these correspond to the variations of population density. The negative coefficient obtained for population density and distance from a city ($r_{13} = -.43$) confirms the hypothesis that these two factors are inversely related. The direct relationship between population density and percentage of cropland is also confirmed by the correlation coefficient ($r_{14} = +.58$). With a series of these coefficients, the second use of this analytical tool, namely as a comparative device, is apparent. The areal association between population and distance is clearly not as close as that between population and precipitation as indicated by the smaller value of the r describing the former. On the other hand, when more than two variables are being considered, judgments of this kind as to relative importance must be made with some caution, since the calculations also show that there is a negative relationship between the distance from a city and rainfall ($r_{23} = -.42$).

In order to eliminate the effect of concomitant relationships among other variables while examining the relationship of any pair,

TABLE 1.—RESULTS OF CORRELATION ANALYSIS[14]

A. Coefficients of Simple Correlation	
r_{12}	$= +.78$
r_{13}	$= -.43$
r_{14}	$= +.58$
r_{23}	$= -.42$
r_{24}	$= +.26$
r_{34}	$= -.16$
B. Coefficients of Partial Correlation	
Three variables:	
$r_{12.3}$	$= +.73$
$r_{13.2}$	$= +.12$
Four Variables:	
$r_{12.34}$	$= +.63$
$r_{13.24}$	$= -.10$
$r_{14.23}$	$= +.39$
C. Coefficients of Multiple Correlation	
(r_{12}	$= +.78$)
R_{123}	$= +.79$
R_{1234}	$= +.90$

[14] Throughout this paper the subscripts refer as follows:
1—Rural farm population density, 1950.
2—Average annual precipitation for the ten-year period 1940–1949.
3—Straight-line distance from the nearest urban center of 10,000 or more people, 1950.
4—Percentage of cropland in the total land area, 1950.

one may employ coefficients of partial correlation.[15] These remove the effects of simultaneous correlations with other factors, and the relative sizes of the coefficients of partial correlation provide a truer description of the relative correspondence of the independent variables with the dependent variable. In the present study, two sets of coefficients were computed (see Table 1). In the first set, two factors, average annual precipitation and distance from a city of over 10,000 people, were included in addition to the dependent variable, rural farm population density. The size of $r_{12.3}$ (+.73) as compared to $r_{13.2}$ (+.12) indicates the much greater importance of rainfall as compared to distance from a city.[16] For the second set, a third independent variable, percentage of cropland in the total land area, was included and a new set of coefficients of partial correlation was computed (Table 1). The hypotheses remained confirmed and again the relative sizes of the coefficients express the relative importance of the factors.

The final step was the calculation of the coefficients of multiple correlation (R). The meaning of R is similar to that of r, in that it is a numerical description of the linear association between the dependent variable and all the independent variables included in its computation. The results (Table 1), show that as additional independent variables are taken into account it is possible to "explain" more and more of the variation in the distribution of rural farm population density. The addition of distance from an urban center of more than 10,000 people increased the correlation coefficient from +.78 to +.79 (r_{12} and R_{123}, respectively). This small increase was to be expected from the small size of the $r_{13.2}$ value (+.12). The inclusion of the percentage of cropland, on the other hand, increased the correlation coefficient from +.79 to +.90 (R_{123} and R_{1234}, respectively).

[15] Formulas for calculating coefficients of partial correlation can be found in any good statistics text. Most make use of the solution of simultaneous equations, the "Doolittle method" often being used for ease of computation if machine methods are not employed.

[16] The subscripts in this case identify the factors being tested as follows: $r_{12.3}$ means the correlation of variables 1 and 2 is obtained, with the effect of 3 being eliminated.

PERFORMANCE MAPPING

The preceding analysis provides only summary statements for the entire area of the relationships between rural farm population density and three other variables. The geographer, however, is ordinarily not satisfied with the areal anonymity of such summary figures. Being interested in the character of specific areas, he wishes to know where these relationships hold close to the regional generalizations and where they do not.

Mapping residuals from regression equations provides a means by which the relationships among phenomena can be seen in their areal setting, generally expressed in the form of isarithmic maps. Linear regression equations ($Y_c = a + b_1X_1 \ldots b_nX_n$) express the average relationship that exists between the dependent variable and the elements selected as independent variables. For example, when the values of rural farm population density, as computed from these formulas (Y_c), are plotted at the centers of the hexagons, they define the density surface that would exist if the distribution of variations in population density corresponded perfectly in a linear fashion with variations of the independent variables considered. The actual rural farm population density surface (Y) naturally does not coincide with the computed surface (Y_c), since in none of the instances is the linear correlation perfect. Therefore, when one maps Y–Y_c he obtains a map showing the performance of the regression equation, that is, a map that shows the magnitudes (and their locations) of the density variations that make the linear correspondence of the variable less than perfect.

One may properly ask: why employ a linear function (from which to map the residuals) rather than a more complex curvilinear function? The answer is that in studying these data the linear function was found to be usable, as is indicated on the maps by the relatively small sizes of the residuals over large areas as well as by the values of the coefficients of multiple correlation. Furthermore it is easier to comprehend the spatial variations of a linear function than those of a more complex function; and if the purpose of a study is primarily to map geographical relationships in such a fashion as to lead to the formulation of additional tentative hypothe-

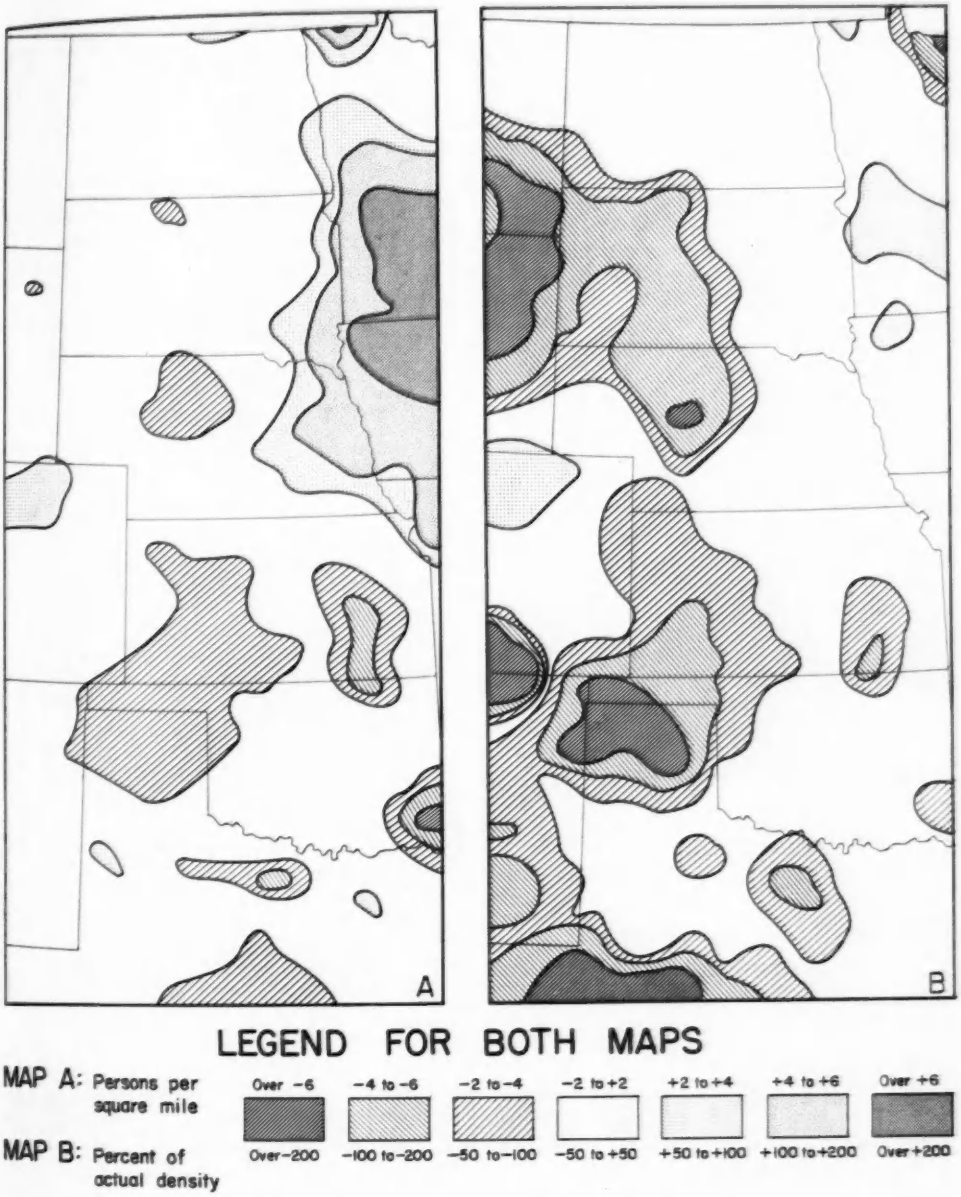

FIG. 4. Maps showing the differences between (1) the actual rural farm population densities and (2) the densities that would exist if the variations of rural farm population density corresponded perfectly with the variations of average annual precipitation. The left-hand map (A) expresses the differences in density terms $(Y-Y_e)$ and the right-hand map (B) expresses the same thing in terms of percentage departure from the actual value $\left(\frac{Y-Y_e}{Y}\times 100\right)$.

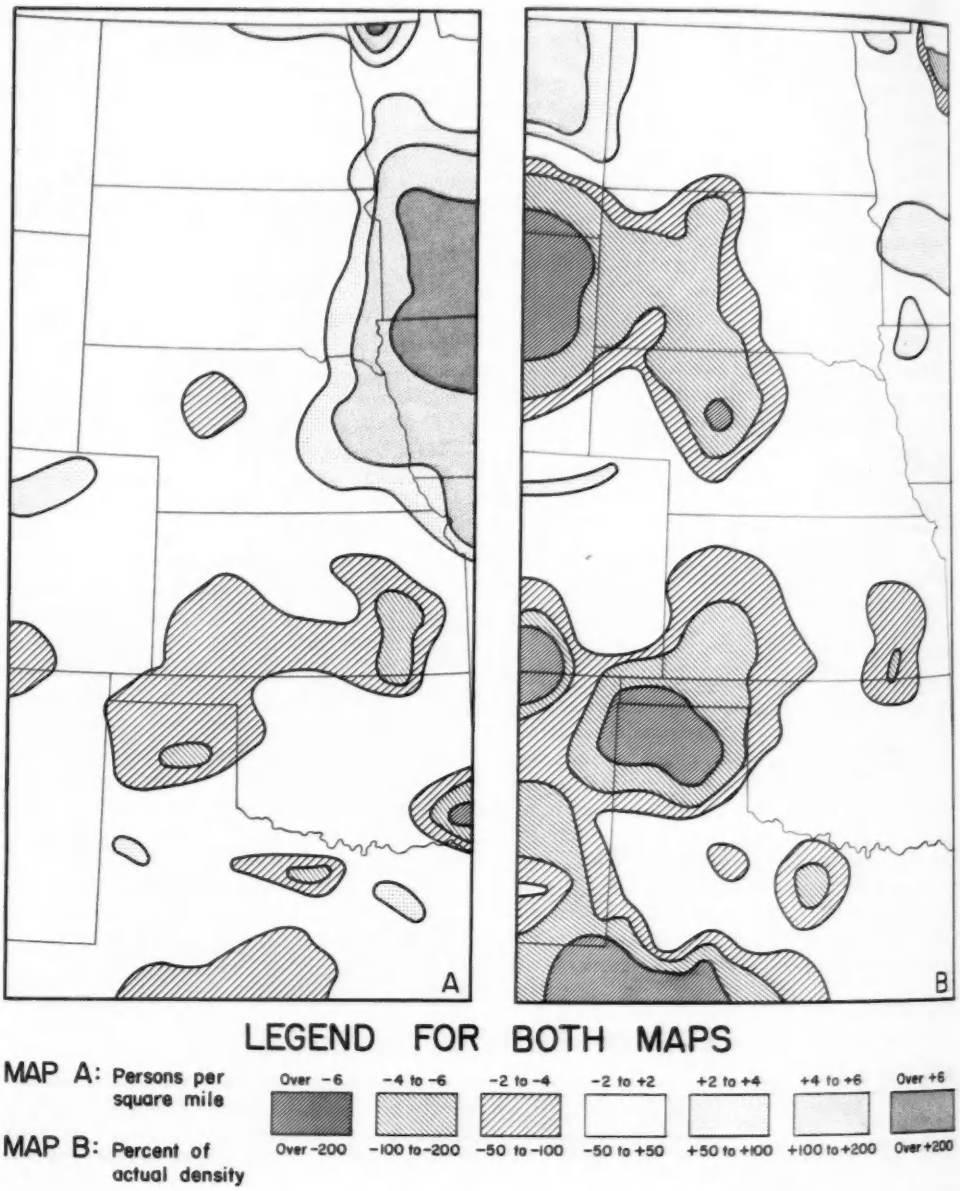

FIG. 5. Maps showing the differences between (1) the actual rural farm population density and (2) the densities that would exist if there were perfect multiple correlation among the variations of density and average annual precipitation and distance from an urban center of 10,000 or more. Map A expresses the differences in density terms and B in percentages of actual densities.

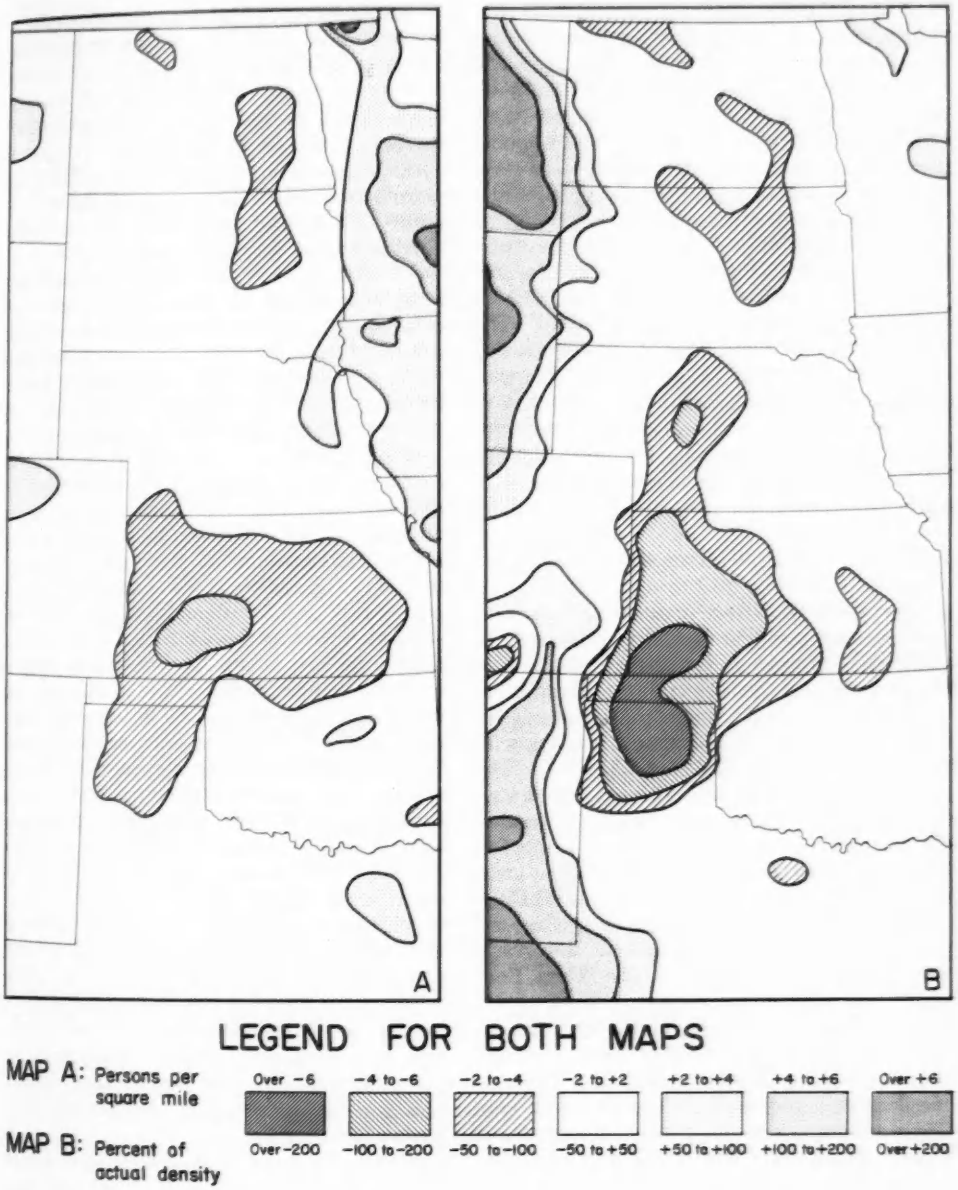

FIG. 6. Maps showing the differences between (1) the actual rural farm population density and (2) the densities that would exist if there were perfect multiple correlation among the variations of density and annual precipitation, distance from an urban center of 10,000 or more, and the percentage of total land in crops. Map A expresses the differences in density terms and B in percentages of actual densities.

ses,[17] then the descriptive statistical base that is least complex yet generally applicable provides the most easily interpreted results.

Three sets of performance maps have been prepared. These show, in effect, the locations of the deviations from the average regional relationship that result in the values $r_{12} = +.78$, $R_{123} = +.79$, and $R_{1234} = +.90$ being less than unity, which would indicate perfect linear correspondence. If the correlations were perfect the regression equations would also describe the relationships perfectly, and there would be no point in making the maps. The departures from the relationship (regression) equations have been calculated and mapped in two ways in each instance. One employs the absolute difference in densities expressed as a number of persons per square mile $(Y - Y_c)$; while the other employs the difference as a percentage departure from the actual density $\left(\frac{Y - Y_c}{Y} \times 100\right)$. The three sets of maps show progressively the effect of utilizing one, two, and three independent variables in the analysis.

Figures 4A and B are the comparison of actual rural farm density with the density that would exist if rural farm population held exactly to its general linear relationship with precipitation ($Y_c = 3.9517 + .3746X_2$). The most extensive areas of positive departure on both maps are in the area generally east of the Missouri River and especially in southwest Minnesota and northwest Iowa. Other areas of positive departure are in northcentral Colorado and in west Texas. There are several possible reasons for these positive departures from "normal." For example the "Corn Belt" type of agriculture prevailing in Iowa, southern Minnesota, and parts of the Dakotas requires a more intensive labor input per land unit. The same reasoning may also apply to the irrigated regions in Colorado and west Texas. Other areas of positive departure in eastern Texas and Oklahoma apparently coincide with the presence of urban centers that seem to attract rural farm population.

Major areas of negative departure are also apparent, particularly on the western portions of the percentage map where a smaller denominator results in large percentage deviations. On both maps of Figure 4, the areas in southeastern Oklahoma and southcentral Kansas coincide with rougher terrain; the Ouachita Mountains and Flint Hills, respectively. The negative departures that occur in much of the southern and western portions of the area may reflect more extensive types of agriculture or may merely suggest that some more sophisticated expression of water availability should be utilized in place of gross average annual precipitation.

Even this brief look at the pattern of deviations from the mean regional relationship of rural farm population density and average annual precipitation has suggested several factors, such as proximity to urban centers, irrigation, roughness of terrain, and labor input per unit area which merit further consideration.

When the factor of distance from an urban center of over 10,000 people is added to the analysis (Figs. 5A and B) few major changes occur, indicating little improvement in the "performance" of the regression equation ($Y_c = -2.6166 + .3498X_2 - .0142X_3$). (Compare Figs. 4 and 5.) Boundaries have changed somewhat, but on the whole the core areas of departures are almost the same as in Figure 4, even near the larger cities in the area, indicating that the factor of distance as measured here is relatively not very important. Somewhat greater changes appear on the percentage map, as for example the positive area in northeast Montana far from an urban center. When the overall differences between Figures 4 and 5 are compared with the small changes in the corresponding correlation coefficients and the small sizes of the values of the coefficients of partial correlation, it is apparent that this result could have been anticipated. Consequently the change in R and the magnitude of the coefficient of partial correlation can be used to estimate whether or not the additional steps of performance calculation and mapping will be worth-while for a particular variable.

Figures 6A and B show the effect of including percentage of cropland in the total land area as the third independent variable. The pattern of departures of actual rural farm population density from the computed density based on all three independent variables undergoes considerable change on both maps ($Y_c = -4.8540 + .3043X_2 - .0118X_3 + .0798X_4$). This is consistent with the increase in the co-

[17] Thomas, *op. cit.*, pp. 8–10.

efficient of multiple correlation ($R_{123} = +.79$ compared with $R_{1234} = +.90$), and with the size of the coefficient of partial correlation ($r_{14.23} = +.39$). Areas of rough terrain are no longer so apparent as they were on Figures 4 and 5.

Negative deviations occur generally in a band running north and south through the center of the area, being particularly strong in western Kansas. Positive departures occur throughout most of the western portions of the area under study although Figure 6A shows that the deviations from "normal" are small in absolute terms. The same areas in Iowa and Minnesota that have been positive throughout are still present although considerably reduced in size. This may indicate that differences in the labor intensity of the various types of farming prevailing in the Great Plains have not been sufficiently accounted for by any factor included in the study. The inclusion of some measure of farm labor per unit of cropland thus might be the next step in a more thorough study.

The authors conclude that the methods of correlation analysis have considerable merit when applied to the study of regional variations. These techniques cannot be applied without difficulties, but these seem no greater than their worth justifies. Certainly, the relative precision of these descriptive and analytical tools together with their cartographic applicability make them useful in geographical study.

A MULTIVARIATE ANALYSIS OF THE SPACING OF URBAN SETTLEMENTS IN THE UNITED STATES

LESLIE J. KING

University of Canterbury, New Zealand

A ubiquitous feature of the American settlement pattern is the urban agglomeration, be it a hamlet, village, town, or city. While these population aggregations display a wide range of internal characteristics, from a functional point of view they frequently have the same *raison d'être,* that is they provide some form of service, however simple it may be, to the dispersed population residing in the surrounding areas.

Insofar as these settlement clusters are unevenly distributed over the surface of the earth, it behooves the geographer to attempt some explanation of their distribution pattern. The most outstanding contribution yet made towards the development of a general theory concerning the distribution, size, and number of urban places within a large area, is that of Christaller. As outlined in his work, *Die zentralen Orte in Süddeutschland,* published in 1933,[1] Christaller's model, generally known as the "central place model," is derived from certain basic premises within a framework of several limiting assumptions. These premises and assumptions have already been discussed by several authors,[2] and for this reason no attempt is made to treat them in this context. However, many of the concepts presented in Christaller's work, for example, the notions of a central place, centrality, complementary region, central goods and services, and the range of a good, are continually stressed throughout this study.

That Christaller's model is inadequate as an approximation of reality is a point which has been emphasized by several writers.[3] These inadequacies stem not only from the very limiting nature of the assumptions, but also from Christaller's use of discrete population-size groups with which there are associated "typical" minimum distances between urban places. Thomas has recently drawn attention to a number of research findings which suggest that such discrete groupings do not appear to be necessary for any explanation of reality.[4] While the studies mentioned by Thomas have ignored any consideration of the spacing of settlements, their findings, by contrast, are extremely relevant to the latter problem. For if discrete population-size groups are unnecessary, then a different basis must be found on which the distances separating settlements can be derived. If the values for population-size appear to be unimodally distributed when they are formed into an array, then it may well be that the distances between urban places are similarly distributed. However, in the quarter of a century or so following the publication of Christaller's work, a majority of studies concerned with the spacing of urban settlements have continued to emphasize the existence of discrete population-size groups and average distances.[5] In addition, little effort has been made towards incorporating additional variables other than the size of population into the analyses.

The present study was undertaken with the expressed need in mind for discovering the nature of the relationships between the spacing of towns on the one hand, and various physical, social, and economic factors on the other. The conclusions drawn from this analysis should contribute towards a firmer foun-

[1] Walter Christaller, *Die zentralen Orte in Süddeutschland* (Jena, 1933). Trans. by C. W. Baskin in, *A Critique and Translation of Walter Christaller's Die zentralen Orte in Süddeutschland* (Unpub. Ph.D. dissertation, Dept. of Economics, University of Virginia, 1957).

[2] See for example: B. J. L. Berry and W. L. Garrison, "A Note on Central Place Theory and the Range of a Good," *Economic Geography,* Vol. 34 (1958), pp. 304–312.

[3] For a pointed criticism along these lines see Egon Bergel, *Urban Sociology* (New York: McGraw–Hill, 1955), p. 64.

[4] Edwin N. Thomas, "Towards an Expanded Central Place Model" (Abstract of paper read at the annual meeting of the Association of American Geographers, Dallas, April 17–21, 1960).

[5] See for example: John E. Brush, "The Hierarchy of Central Places in Southwestern Wisconsin," *Geographical Review,* Vol. 43(1953), pp. 380–402. August Lösch, *Die räumliche Ordnung der Wirtschaft* (Jena, 1944). Trans. by W. H. Woglom and W. F. Stolper as, *The Economics of Location* (New Haven, 1954).

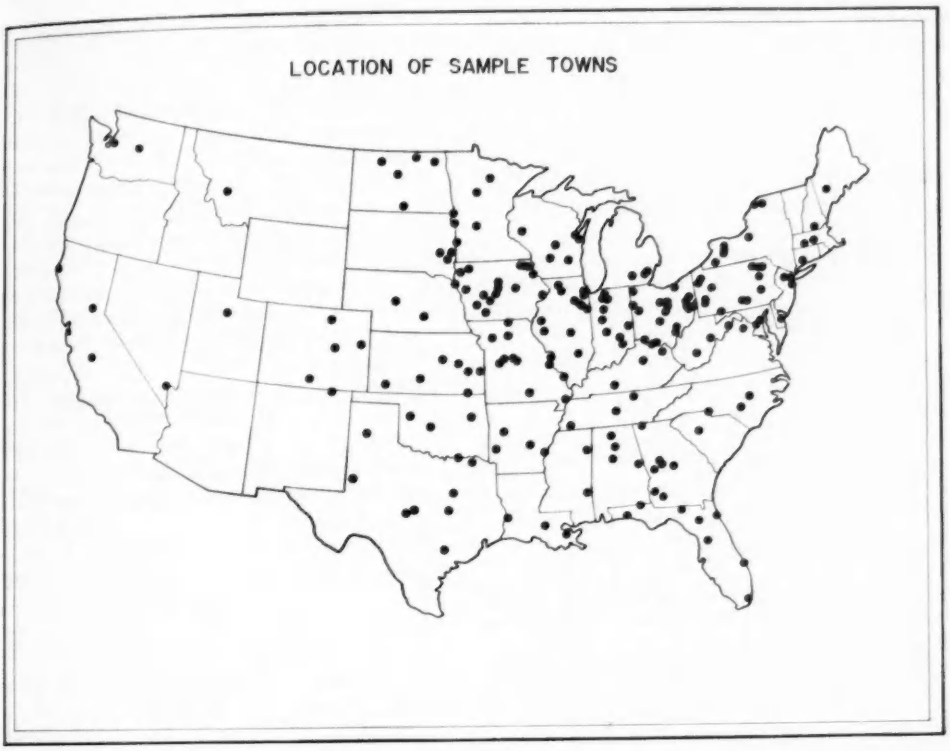

FIGURE 1

dation for the construction of a general theory concerning the distribution pattern of towns over the face of the earth.

Specifically, with reference to a random sample of two hundred urban settlements, this study will attempt to explain the areal variation throughout the United States in the distances separating the towns from their nearest neighbors of the same population-size. The use of simple and multiple regression analyses will allow for consideration of the effects, either independently or simultaneously, of selected physical, social, and economic variables upon this set of distances.

THE SAMPLE TOWNS AND THE DEPENDENT VARIABLES

A sample of two hundred towns was drawn randomly from the list of Incorporated Places and Unincorporated Places of over 1,000 inhabitants, contained in the 1950 United States Census of Population.[6] The towns were chosen with the aid of a random-numbers table after the members of the entire universe had been numbered consecutively. The settlements which were thus selected (Fig. 1), ranged in population-size from 5 (Slaughter Beach, Delaware) to over 467,000 (Seattle, Washington).

If, as an initial assumption, it is accepted that each of these sample towns is a central place in the sense that it exists to serve the inhabitants of some surrounding areas, then in the light of "central place theory" the relative location of each of these towns can be viewed as a function of the extent to which it has been able to exist in proximity to the nearest neighboring town of the same population-

[6] U. S. Bureau of the Census, *Seventeenth Decennial Census of the United States: Census of population, 1950*, Vol. 1, "Number of Inhabitants" (Washington: Govt. Printing Office, 1952), Table 7.

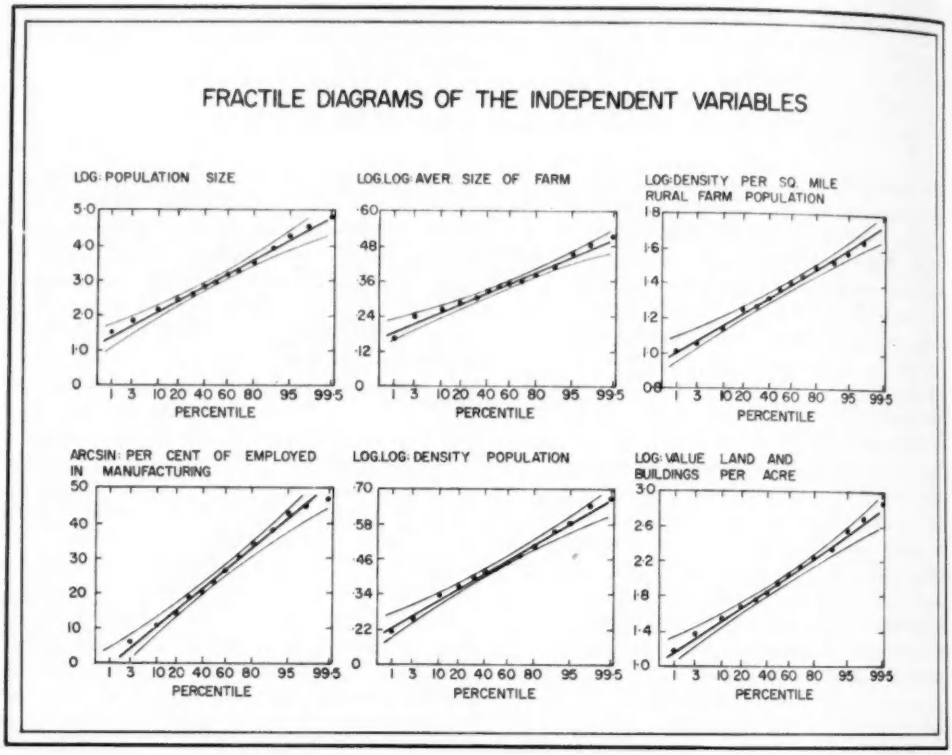
FRACTILE DIAGRAMS OF THE INDEPENDENT VARIABLES
LOG POPULATION SIZE
LOG LOG AVER. SIZE OF FARM
LOG DENSITY PER SQ. MILE RURAL FARM POPULATION
ARCSIN PER CENT OF EMPLOYED IN MANUFACTURING
LOG LOG DENSITY POPULATION
LOG VALUE LAND AND BUILDINGS PER ACRE
PERCENTILE
1 3 10 20 40 60 80 95 99·5

FIGURE 2

size and functional complexity as itself. Implicit in the latter part of this statement is also the assumption of a positive relationship between the population-size of a town and the number and complexity of goods and services offered in it. That these initial assumptions may be unrealistic need cause no great concern since the discrepancies between the model and reality are expected to show up as large residual values in the subsequent regression and correlation analysis.

Areal variations in the distances separating towns of the same population-size, should reflect not only the population-size and functional complexity of the towns concerned, but also the influence of any factors which affect demand and the range of the goods and services offered by the towns.

The problem of providing an operational definition for the variable *distance between two towns of the same population-size*, has already been considered in detail by Thomas.[7] With respect to the *ith* city, the nearest neighbor of the same population-size is defined as "that place which is located spatially nearest to the sample city and has a population differing from the population of the sample city only by chance." A more formal definition in terms of fiducial limits is given as $S_i - xE_i \leq N_i \leq S_i + xE_i$, where S_i is the population of the sample town, N_i the population of the nearest neighbor, E_i is a random error value, and x is the standard abscissa of the normal curve associated with a desired confidence level. The definition is not without its weaknesses. As Thomas points out, the fact that some normalizing transformation of the population-size data is frequently required, is one such weakness. Furthermore, the model is essentially a static one. Two urban places may be of the same population-size in 1950,

[7] Thomas, *op. cit.*

but when population changes through time are taken into account, then it is likely that this relationship between the two towns will vary considerably. These weaknesses notwithstanding, Thomas appears to have provided a reasonably precise and logically acceptable definition of the notion of same population-size. The use of this stochastic model, however, is conditional upon the fulfillment of the basic assumptions of a random sample drawn from a normally distributed population with respect to population-size. It has already been noted that the sample of towns was randomly chosen. The use of a fractile diagram, as a test for normality,[8] revealed that the distribution of the population-size data was considerably skewed in character and a logarithmic transformation was necessary to ensure normality at the ninety-five percent confidence level (Fig. 2).

Having established the population-size intervals, and subsequently identified the nearest neighbor of the same population-size for each sample town, then the set of distances which is the dependent variable could be derived. As was the case with population-size, the distribution of these distances was markedly skewed to the right. Since the level of confidence associated with the subsequent statistical analyses will be verified by tests of significance which presuppose samples from normally distributed populations, it is desirable that all the variables used in this study be transformed when necessary to ensure a normal distribution.[9] In the case of the dependent variable, a logarithmic transformation appeared adequate (Fig. 3).

THE FORMULATION AND TESTING OF AN INITIAL SET OF HYPOTHESES

In formulating the following hypotheses concerning the spatial association of the dependent variable and selected independent variables, it must be emphasized that the variables chosen are the ones which appear to be logically the most relevant. The degree to which they are spatially associated with the dependent variable and thereby provide a satisfactory explanation of the areal variation in the magnitude of the distances separating towns of the same population-size, will be revealed by the subsequent statistical analyses. The amount of unexplained variation in the dependent variable, will be indicative not only of the aptness of the operational definitions used in this study, but also of the relative importance of the variables chosen and those which have been neglected. In addition, each hypothesis is formulated within a probability framework, although this may not always be made explicit. However, the acceptance or rejection of any hypothesis is with respect to some predetermined level of probability or confidence.

First, the distance between two towns of the same population-size should reflect the actual population-size of the two towns in question.[10] That is to say, the distance separating a large city from its nearest neighbor of the same size will be much greater than the corresponding distance between two small hamlets, for the larger urban settlement offers more specialized services which have a far greater range than do the more basic services contained in the smaller centers. The greater the range of the services offered by a town, the farther apart it will be located from the nearest town offering similar services.

Second, in the areas of more intensive farming, where there are relatively higher inputs per unit area of the factors of production, the demand for central services should be greater than in the areas where these inputs are on a much lower level. Consequently, if the availability of transportation facilities is considered relatively constant throughout the country, it is expected that towns should be located closer together in the areas of intensive farming, and conversely, farther apart in the areas of more

[8] A. Hald, *Statistical Theory with Engineering Applications* (New York: John Wiley and Sons, 1952), pp. 119–158.

[9] The various transformations used in this study are shown in Figure 2. For discussions of data transformation see: J. Aitchison and J. A. C. Brown, *The Lognormal Distribution* (Cambridge: University Press, 1957). Also: Edwin N. Thomas, *An Analysis of the Areal Associations Between Population Growth and Selected Factors Within Outlying Cities of the Chicago Urbanized Area.* (Unpub. Ph.D. dissertation, Department of Geography, Northwestern University, 1958).

[10] Population data obtained from U. S. Bureau of the Census, *op. cit.* It should be noted at this point that the distances mentioned in this study are the airline distances between the approximate geographic centers of the towns, as measured on the *U. S. Bureau of Census Maps* (Washington: Govt. Printing Office, 1940).

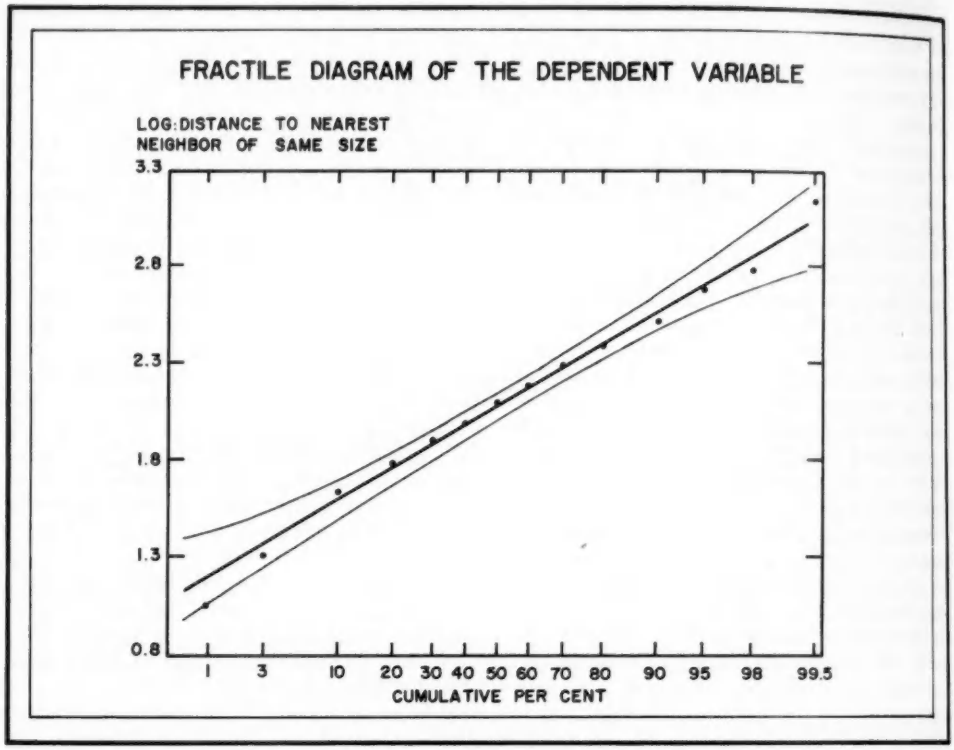

FIGURE 3

extensive farming. For the purposes of this investigation the scale of farming operations is defined in terms of the average size of farm in 1950 for the county in which the sample town is located.[11] A positive relationship between farm size and distance is hypothesized. At this point attention should be drawn to the fact that county averages and density figures are used throughout this study as dimensionless terms indicative of the character of the trade area of the town concerned. It has already been suggested that the distance between two towns of the same population-size should in part reflect the character of the intervening area which they serve.

Third, as a corollary of the preceding hypothesis it is expected that the density of rural farm population will be inversely associated with distance. Christaller maintained that a greater rural farm population density would encourage a higher consumption of goods, a greater degree of labor specialization, and a greater use of capital necessary for central goods.[12] Therefore, where rural farm population density is high, the system of service centers should be more strongly organized and the distance between towns shorter than in areas characterized by a low density of rural farm population.[13]

Fourth, in the discussion so far, towns have been considered purely as service centers. However, there are many, perhaps even a majority of urban settlements which serve a different function. For those towns which exist

[11] Data obtained from U. S. Bureau of the Census, *1954 Census of Agriculture* (Washington, D. C.: Govt. Printing Office, 1956).

[12] Christaller, *op. cit.*, pp. 148–151.

[13] U. S. Bureau of the Census, *Seventeenth Decennial Census of the United States: Census of Population, 1950*, Vol. 2 (Washington, D. C.: Govt. Printing Office, 1952).

primarily as manufacturing centers, an additional set of assumptions must now be introduced. These involve factors known in general location theory as *agglomeration economies*,[14] and the effects of these might well be evidenced in a closer spacing of larger manufacturing centers. Since published data on manufacturing is unavailable for towns of less than 2,500 population, which constitute two-thirds of the present sample, reliance was placed upon county data,[15] and the importance of the agglomerative factors was defined in terms of the percentage of the employed population engaged in manufacturing in the county for 1950. The specific hypothesis is that where the percentage is high, the towns will be located closer together.

Fifth, of the two hundred towns selected for this study, thirty-four are located in Standard Metropolitan Areas, but are not in themselves central cities in terms of the Census definitions.[16] The distances separating these towns from their nearest neighbors of the same size are often very small, as is the case for example with McCook (Chicago), Capitol Heights (Washington, D. C.), and West Brookfield (Worcester, Massachusetts). For each of these towns the distance measurement lies at least two standard deviation units below the sample mean. In addition, many of these towns are quite large in population-size and it appears likely that the positive relationship between population-size and distance which has already been hypothesized, may not exist in these highly urbanized areas. It is pertinent, therefore, to consider a possible relationship between total population density and the spacing of towns of the same population-size.[17]

Sixth, in areas of higher agricultural productivity there is presumably a higher level of rural purchasing power which should be reflected in a greater consumption and demand for central goods and services. Christaller insisted that if such is the case then the system of central places should be more strongly developed and as a result towns should be more closely spaced.[18] The value of land and buildings per acre by county has been suggested as one index of agricultural productivity,[19] and, notwithstanding the weaknesses associated with this index, it is hypothesized that in areas characterized by high values of land and buildings per acre towns will be spaced closer together than in areas of lower agricultural productivity.[20]

TABLE 1

Variable	Simple correlation coefficient	Coefficient of determination	"b" Values for multiple regression analysis
Population of town	.15*	.02	.13*
Average size of farm	.33*	.10	–.02
Density rural farm pop.	–.24*	.05	–.14
Percent in manufacturing	–.34*	.11	–.05
Density total population	–.41*	.17	–.12*
Value of land and bldgs. per acre	–.30*	.09	–.10

* Significant at the ninety-five percent confidence level.

A simple regression analysis in which the regression of the dependent variable on each independent variable is considered without reference to the effects of the other independent variables, substantiated each of the above hypotheses. That is to say, there was a statistically significant relationship between each independent variable and the dependent variable (Table 1).

However, the coefficient of determination (r^2) is in each case comparatively small. While the variable, *density of total population*, accounts for seventeen percent of the variation in the dependent variable, only in the cases of three of the remaining variables is there as much as ten percent explained variation. These results would seem to support the tentative conclusion that the spacing of towns is a very complex phenomenon, and that an explanation of it will involve consideration of a greater number of variables than has so far been the case. The multiple regression analysis adds greater weight to this conclusion, for when

[14] Walter Isard, *Location and Space Economy* (New York: John Wiley and Sons, 1956), pp. 172–188.

[15] U. S. Bureau of the Census, *op. cit.*

[16] That is to say they are not in terms of the Census definitions, Principal central cities of 50,000 inhabitants or greater, or Central cities of 25,000 or more.

[17] U. S. Bureau of the Census, *op. cit.*

[18] Christaller, *op. cit.*, p. 150.

[19] N. E. Salisbury, "Agricultural Productivity and the Physical Resource Base of Iowa," *Iowa Business Digest*, Vol. 31(1960), pp. 27–31.

[20] U. S. Bureau of the Census, *1954 Census of Agriculture*, *op. cit.*, Chap. B., Table 1.

TABLE 2.—MATRIX OF INTERCORRELATIONS FOR THE SIMPLE REGRESSION ANALYSIS

	X_1	X_2	X_3	X_4	X_5	X_6
X_1 Population of town	...	−.13	−.03	.15	.21	.16
X_2 Average size of farm		...	−.53	−.49	−.78	−.60
X_3 Density rural farm population			...	.25	.45	.24
X_4 Percent in manufacturing				...	.65	.30
X_5 Density of total population					...	.71
X_6 Value of land and buildings per acre						...

all six independent variables are considered simultaneously, only twenty-five percent of the variation in the dependent variable could be accounted for. While this represents somewhat of an improvement over the results of the simple regression analysis it is nevertheless a disappointing result. Furthermore, in the multiple regression analysis only two of the variables appear to contribute significantly in explaining the variation in the dependent variable (Table 1, Column 4). That the remaining four variables are not statistically significant, appears to reflect in part the comparatively high intercorrelations between each of these variables and the *density of total population* (Table 2).

The analysis henceforth, can proceed in either of two directions. On the one hand, an expected value of the dependent variable could be derived for each sample city by the use of the regression equation, $Y = 28.6 + .13X_1 - .02X_2 - .14X_3 - .05X_4 - .12X_5 - .10X_6$. The numerical difference between this expected value and the observed value is termed the *residual*, and it provides for each city a measure of how closely the regression estimate fits the observed value. On the basis of a map of these residuals and knowledge pertaining to some of the deviant cases, new hypotheses could be formulated and additional variables as a means of testing these hypotheses could then be incorporated into the analysis. Such an approach, with the addition and deletion of variables, the formulation and testing of new hypotheses, would be pursued until an acceptable level of explanation was achieved. Alternatively at this point an attempt might be made to assess, by means of covariance and tests of significance, the importance of certain regionalizations and classificatory groupings in explaining the variation in the dependent variable. These regional divisions may be made with reference to some factor which is qualitative rather than quantitative in nature, or they might represent multivariate regions in which numerous subtle forces are known to be operating. It is along the lines of this second approach that the remainder of this study is oriented. The following hypotheses are outlined as the framework within which this subsequent analysis is set:

First, there are many towns included within the sample which are obviously not true central places in the sense of existing primarily as service centers for surrounding rural areas (Fig. 4). Christaller designated such towns as "pointly-bound" places.[21] It is anticipated that a grouping into central and non-central places along these lines will be significant in helping to explain the variation in the dependent variable.

Second, as yet no explicit recognition has been accorded to physical factors such as relief, elevation, or roughness. Intuition alone suggests that these factors may be critical in the location of any urban settlement. However, the problems of isolating and then measuring the relevant variables have precluded their consideration. A regional classification on the basis of slope may reveal some interesting conclusions. For the purposes of this study Hammond's classification of the terrain types of North America was used.[22] The system was generalized in that Hammond's eight main types were combined into two. The first includes those areas which have at least fifty percent of their area in "near level land," which is defined as land characterized by slopes of less than eight percent, while the second group includes those areas with lower percentages of "near level land."

Third, although variables relating to some aspects of agriculture have already been included within the analysis, it is hypothesized that a classification of the towns on the basis of the type of farming area in which they are located, may reveal some interesting facets of

[21] Christaller, *op cit.*, p. 116.

[22] Edwin H. Hammond, "Small-Scale Continental Landform Maps," *Annals*, Association of American Geographers, Vol. 44(1954), pp. 33–42.

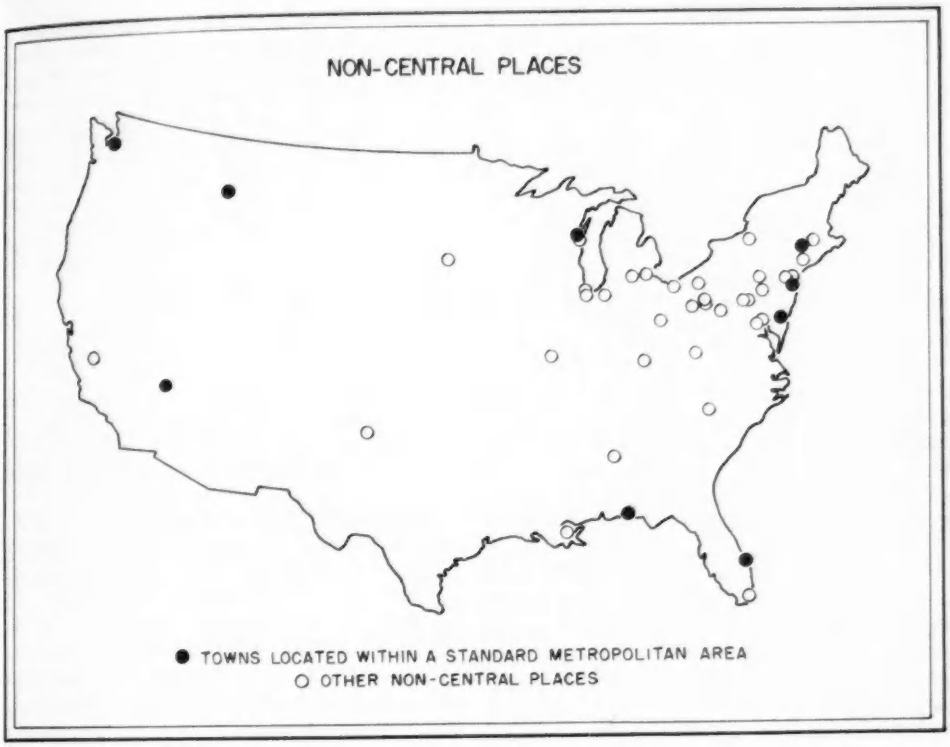

FIGURE 4

the problem. Throughout the United States, farming has developed in response to numerous physical, biological, social, and economic forces which are explicitly recognized in the United States Department of Agriculture's classification of generalized farming types.[23] However, since some of the farming types included within this scheme contained only one or two if any, of the sample towns, a simplification was made by combining several of the types according to the general scale on which the type of farming is practiced. Thus Group I includes the extensive farming types, "Wheat and Small Grains" and "Range Livestock." Group II on the other hand, is made up of the more specialized farming types including "Fruit, Truck, and Mixed Farming," "Cotton," "Tobacco and General Farming," and "Special Crops and General Farming." Group III is the "General Farming" type, while Group IV represents the "Feed Grains and Livestock" complex. Finally, the "Dairy" areas are considered as Group V.

THE COVARIANCE MODEL AND THE GROUPINGS EXAMINED

Assuming that the sample units have been grouped or regionalized on some logical basis, then it is of interest to know whether or not the introduction of this subdivision accounts for a significant amount of the variation in the dependent variable, apart from the regression of this variable on the independent variables.

The importance of regionalizations or classificatory groupings in this respect can be established by an analysis of covariance, providing the assumptions underlying this model are fulfilled. The assumptions are firstly that the variance of the dependent variable does not differ significantly from group to group,

[23] U. S. Dept. of Agriculture, "Generalized Types of Farming in the United States," *Agric. Information Bull.* No. 3 (Washington, D. C.: Govt. Printing Office, 1953).

TABLE 3

Coefficient of correlation[1]	Central places	Non-central places
Y.123456	.51*	.65*
$Y.X_1$	.29*	.08
$Y.X_2$	.27*	.36*
$Y.X_3$	−.17*	−.39*
$Y.X_4$	−.32*	−.35*
$Y.X_5$	−.32*	−.60*
$Y.X_6$	−.26*	−.33*

[1] In this table the dependent variable is designated by Y, while the independent variables are listed in the same order as in Table 1. (*Significant at the ninety-five percent confidence level.)

TABLE 4.—BETA VALUES FOR THE INDEPENDENT VARIABLES SIGNIFICANT IN THE MULTIPLE REGRESSION ANALYSES FOR THE SUBGROUPS

Variable	Central places	Non-central places	Group I. Grazing & wheat	Group II. Specialized farming	Group III. General farming	Group IV. Feed grain & livestock	Group V. Dairying
X_1	.32	–	.50	–	–	.52	–
X_2	–	–	.71	–	–	–	.68
X_3	–	–	–	–	.26	–	–
X_4	.24	–	.60	.41	–	–	–
X_5	–	.65	.76	–	–	–	.83
X_6	–	–	–	–	–	–	–

and secondly that the subgroup regression lines are parallel. When these assumptions appear unwarranted, then tests of the statistical significance of the difference between coefficients of correlation may be employed to determine the relevance of the subdivision.[24]

Central and Non-central Places

An analysis of covariance was precluded in this case by unequal variances. However, the results of the regression analysis for each group were significant. In the simple regression analysis, for example, five of the independent variables showed up as being significantly related to the dependent variable in both groups. The exception was the variable, *population-size of the sample town*, which did not appear significant in the group of non-central places (Table 3). In the group of central places the most closely related variable was *the percent of the employed engaged in manufacturing*, and, as was the case for the whole sample, the relationship with distance was an inverse one. However, the amount of explained variation accounted for by this manufacturing variable was only ten percent. In the group of non-central places, on the other hand, the variable *density of total population* explained almost thirty-seven percent of the variation in the distances separating towns of the same population-size. The direction of this relationship was in agreement with that for the sample as a whole, but in this case the level of explained variation was much higher than had previously been the case.

The coefficients of multiple correlation for the two subgroups did not differ significantly either with respect to the multiple correlation coefficient for the complete sample or with respect to one another, and therefore the grouping appeared to have little significance. However, in the case of the non-central places the amount of explained variation was almost forty-two percent which represents a considerable improvement on the level achieved for the sample as a whole. At the same time it should be noted that only one variable, *density of total population*, showed up as being significant in the multiple regression analysis for this subgroup (Table 4), and it will be remembered that this same variable alone accounted for as much as thirty-seven percent of the variation in the dependent variable in the simple regression analysis. For the group of central places two variables were significant in the multiple analysis, namely, *the population-size of the sample town*, and *the percent of the employed engaged in manufacturing*, and the first of the two appeared to be the more important in explaining the variation in the dependent variable (Table 4).

Physical Slope Regions

In contrast to the preceding subdivision, the regionalization on the basis of slope could be evaluated by means of an analysis of covariance since the assumptions of equal variance and parallel regression planes were ful-

[24] For discussions of the regional problem and the use of covariance and tests of statistical significance in this regard, see: Donald J. Bogue and Dorothy L. Harris, "Comparative Population and Urban Research via Multiple Regression and Covariance Analysis," *Studies in Population Distribution: No. 8* (Oxford, Ohio: Scripps Foundation, 1954). Also Leslie J. King, *The Spacing of Urban Places in the United States* (Unpub. Ph.D. dissertation, Department of Geography, State University of Iowa, 1960).

TABLE 5.—ANALYSIS OF COVARIANCE

Source of variation	Variance of Y			R^2	Errors of estimate		
	df	Σy^2	Mean Sq.		df	Sum of Sq.	Mean Sq.
Total	199	2794		.25	193	2092.02	
Subgrp. means	1	41	41				
Within subgrps.	198	2753	14	.32	192	1871.34	9.74
For test of the significance of the adjusted subgroup means					1	220.68	220.68

Test for Parallel Regressions: $F = 41/14 = 2.9$. Not significant.

Test for Adjusted Means: $F = 220.68/9.74 = 22.63$. Significant.

$r_{YY_e} = .57$

filled.[25] Formal evidence as to the statistical significance of the regional grouping is presented in Table 5.

The regionalization appeared significant and the amount of explained variation in the dependent variable was increased from twenty-five to thirty-two percent.[26]

Types of Farming

While the assumption of equal variances was fulfilled in this case, the fact that the regression planes were not parallel precluded any meaningful analysis of covariance. However, some significant information was forthcoming from an examination of the regression analyses for the subgroups.

The simple regression analysis emphasized the relative importance of different variables in the different subgroups (Table 6). For example, in the areas of extensive farming (Group I), over forty percent of the variation in the dependent variable could be attributed to the comparatively close relationship between *distance* and *the population-size of the sample town*. In addition, in the same areas *the density of rural farm population* accounted for almost twenty percent of the variation in the dependent variable. In the areas of specialized farming (Group II), only one variable *the percent of the employed engaged in manufacturing* appeared significantly related to *distance* and even then the amount of explained

[25] The tests of statistical significance used in this analysis may be found in: George W. Snedecor, *Statistical Methods* (Ames: Iowa State College Press, 1956), pp. 316–319.

[26] See Bogue and Harris, *op. cit.*, pp. 69–71.

TABLE 6

Coefficient of correlation	Group I	II	III	IV	V
Y.123456	.81*	.44	.81*	.58*	.60*
YX_1	.65*	.11	−.27	.47*	.21
YX_2	−.01	.24	.49*	.17	.01
YX_3	−.44*	−.15	.16	−.24	.01
YX_4	.39	−.30*	−.50*	−.11	−.36*
YX_5	−.18	−.22	−.62*	−.22	−.30*
YX_6	.00	−.22	−.74*	−.16	−.19

* Significant at the ninety-five percent level.

variation accounted for by this variable was very low ($r^2 = .09$). By contrast, as many as four variables appeared significant in the general farming region (Group III), and of these *the value of land and buildings per acre* accounted for as much as fifty-five percent of the variation in the dependent variable for this subgroup. In the areas of feed grain and livestock economy the distance separating two towns of the same population-size again appeared to be some function of the *population-size of the sample town*, this being the only independent variable which in this group showed up as being significantly related to the dependent variable. Finally, in the dairy region both the *density of total population* and *the percent of the employed engaged in manufacturing* were significantly related to *distance* in an inverse direction, but the level of explained variation in either case was not very high ($r^2 = .09$ and .13 respectively).

This pattern in which certain relationships appear to be significant in one region but not in another was emphasized by the results of the multiple regression analysis. In only one of the groups, that of specialized farming, was the coefficient of multiple correlation insignificant. In the remaining groups, by contrast, the multiple relationship between *distance* and the six independent variables was often very close, and in the cases of Groups I and III the coefficient of multiple correlation differed significantly from that of the sample as a whole, thereby suggesting that this classification based upon farming types is of some significance in helping to explain the areal variation in the distances separating towns of the same population-size. For Groups I and III the level of explained variation was in each case higher than sixty-five percent. However, it was again apparent from Table 4, that not

all of the variables contributed significantly to the multiple regression within each subgroup. Also, it is important to note that in some cases a variable which was not significant in the simple regression analysis proved to be significant in the multiple analysis. Such was the case, for example, with the variable, *density of rural farm population*, in the general farming group. This emphasizes the fact that many geographic problems are extremely complex in nature and the holding of certain factors constant in the multiple regression analysis may reveal important relationships which a simple regression analysis may in fact conceal.

CONCLUSION

When an overall appraisal is made, the preceding analysis appears most inadequate as an explanation of the areal variation in the distances separating towns from their nearest neighbors of the same population-size. This is emphasized by the fact that when all six independent variables were considered simultaneously, only two proved to be significant in contributing to an explanation of the variation in the dependent variable, and even then these two could account for no more than one quarter of the total variation. Nor did the introduction of certain regionalizations and classificatory groupings raise the overall level of explanation much higher, except on a level within subgroups.

At this point it is relevant to consider the possible sources of these inadequacies. The obvious need for the inclusion of additional variables into the analysis has already been stressed. In addition, some of the operational definitions used in this study may be inadequate. For example, it was assumed that the population-size of a town was a good index of the town's functional complexity, but such a close positive relationship between these two factors may be non-existent with respect to a sample of towns drawn from the whole of the United States. The index of rural purchasing power, namely, the value of land and buildings per acre, also appears to have serious limitations and preferably some direct income statistic might be sought.

The use of the county area as an approximation of the trade area of a town is also burdened with difficulties. Not only do county areas vary considerably in size—a fact that can be partially compensated for by the use of dimensionless statistics—but in addition it is often the case that more than one sample town of varying population-size are located in the same county area and are therefore assigned the same data for many of the variables.[27]

The results of the regression analysis must also be supplemented by some acknowledgment of the chance factor in the location of towns. The system of towns with which this study deals cannot logically be conceived of as a completely deterministic system in which every variable is in fact a function of the others, but rather it represents a system in which chance elements are likely to be present. The relative importance of these stochastic elements, however, has yet to be determined. Nevertheless, such considerations appear to be very pertinent when dealing with such a diverse area as the United States in which "pointly-bound" places may well be the rule rather than the exception. In this sense the distance separating two towns of the same population-size in 1950 might be simply a random phenomenon. On the other hand, if allowance is made for the notion of a functional interdependence between a town and the surrounding rural area, then it is apparent that more detailed information is required concerning such topics as the actual extent of a town's trade area and the nature of consumer trip behavior. Also, as far as the relative location of any town is concerned, there is a need for greater insight into the number and size of the towns which were already in existence within an area at the time that the town in question came into being. Furthermore, the fact that the operational definition of same population-size which is employed in this study is essentially a static one emphasizes the need for projecting the study back into the past.

These are but a few of the questions which might be raised concerning the problem of

[27] Such was the case for example, with the towns of Ossian and Spillville in Winneshiek County, Iowa. The former with a population of 804 would necessarily have a larger trade area in accordance with the assumptions underlying this study, than would Spillville with a population of only 363. However, in each case Winneshiek County alone was accepted as an approximation to the character of their respective trade areas.

explaining the spatial distribution of urban places. Despite its many limitations the present study has contributed some understanding of this problem, in that it has demonstrated the existence of meaningful relationships between distance and certain independent variables within the universe of the United States, while at the same time it has focussed attention upon the meagerness of present understanding in this very same area.

TOPOGRAPHIC EFFECTS OF FAULTING: DEATH VALLEY, CALIFORNIA[1]

CHESTER B. BEATY
Montana State University

IT is generally accepted that Death Valley is of structural origin and that its major lineaments have been determined by large-scale faults, probably both normal and reverse.[2] Landscape features produced by faulting are especially conspicuous along the eastern side of the southern arm of the depression, where the forbidding slopes of the Black Mountains plunge abruptly beneath the alluvial fill of the valley floor.[3] Embryonic alluvial fans, exceedingly steep bedrock slopes, and the comparatively straight alignment of much of the mountain front all attest to relatively recent orogenic activity, and provide the student of physiographic change with a veritable open textbook of diverse forms.

Although the area of the western front of the Black Mountains is perhaps the best known part of Death Valley, the northern branch of this great structural trough, between the Grapevine and Cottonwood mountains, also contains many features of interest to the geomorphologist. Prominent among these is a series of deeply dissected and reworked alluvial fans located south of Titus Canyon along the foot of the Grapevine Mountains (Fig. 1). These fans have been built by ephemeral streams heading in the limestone terrain of the adjacent highlands. They vary in size from a few hundred feet to a mile or more in radius, and the steepness of their slopes ranges from a minimum inclination of three degrees to an extreme of twenty to twenty-five degrees. The debris from which they have been constructed is predominantly in the coarse gravel–cobble range, with numerous larger boulders, and the amount of finer material is limited. Without exception, all of the fans have one notable morphologic feature: a deeply incised channel cutting far into the apex region, and leading down to a newer part of the fan, the lower inclination and lighter color of which contrast vividly with the darker, steeper slopes of the upper surface (Figs. 2 and 3). The strikingly similar morphologic condition of all of these fans suggests a common cause for their state of dissection, a cause that could have been climatic, tectonic, the result of local topographic and lithologic differences, or perhaps a combination of two or more of these.

FIG. 1. Index map of Death Valley area, California and Nevada.

[1] Initial field work for this study was done in March, 1957, in connection with an investigation of desert flooding for the U. S. Quartermaster Corps; see J. E. Kesseli and C. B. Beaty, *Desert Flood Conditions in the White Mountains of California and Nevada* (Natick, Mass.: QM Research and Engineering Command, U. S. Army, Technical Report EP-108, 1959). Further work was undertaken in March and April, 1958, during a trip financed by the Department of Geography, University of California, Berkeley.

[2] See Thomas B. Nolan, *The Basin and Range Province in Utah, Nevada, and California* (U. S. Geological Survey Professional Paper 197-D, 1943); A. J. Eardley, *Structural Geology of North America* (New York: Harper and Brothers, 1951), pp. 475–87.

[3] Norman E. A. Hinds, *Evolution of the California Landscape* (California Division of Mines, Bulletin 158, 1952), p. 72.

FIG. 2. Dissected alluvial fan along the western flank of the Grapevine Mountains in northern Death Valley.

FIG. 3. Another dissected fan in northern Death Valley. The truck at the toe of the newer segment of the fan gives some indication of scale.

FIG. 4. Dissected alluvial fan in northern Death Valley built by the second unnamed intermittent stream south of Titus Canyon. Photograph made from near perimeter of lower segment of the fan.

It is the purpose of this paper to examine one of the fans in detail and to present evidence that recent faulting, in this one case, at least, is directly responsible for the present state of physiographic development.

FAULTING AND FAN MORPHOLOGY

The dissected fan in question (Fig. 4) has been built by the second unnamed ephemeral stream south of Titus Canyon (see Fig. 1). The middle third or fourth of the fan has been literally carved away by the intermittent stream. The material thus removed has been spread below the margin of the original fan in the form of a lower and newer fan, the apex of which extends into the incised portion of the older form (Fig. 5). Obviously the original fan is in a state of active and vigorous destruction.

A number of reasons could be advanced to account for the profound entrenchment of the older portion of this compound fan. It has been argued fairly persuasively, for example, that an increase in total annual precipitation would lead to an increase in the density of the vegetal cover on slopes in arid and semi-arid regions, the effect of which would be to reduce the load of debris carried by intermittent streams and thus to increase their ability to erode.[4] Such a change in climate conceivably could have occurred in the recent geologic past in the Death Valley region.

But a somewhat more convincing case has been made for the contention that exactly opposite conditions should have prevailed. According to some students of desert land forms, arroyo cutting—and, by analogy, alluvial fan entrenchment—is to be correlated with periods of increased aridity. A decrease in precipitation, it has been said, would favor a decrease in the amount of vegetation on the slopes, leading to a more rapid runoff of surface waters and a consequent degradation of

[4] Ellsworth Huntington, *The Climatic Factor as Illustrated in Arid America* (Carnegie Institute of Washington, Pub. No. 192, 1914), pp. 23–26.

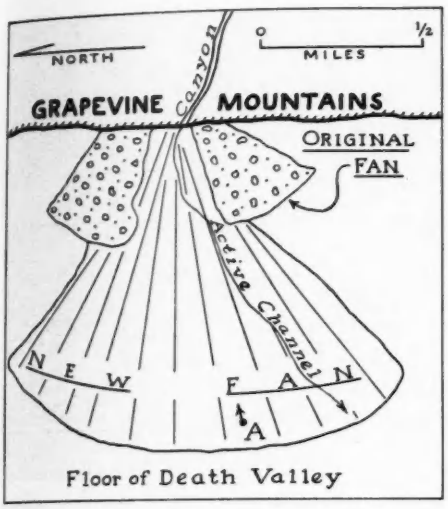

FIG. 5. Diagrammatic sketch map of dissected alluvial fan showing relation of original fan to newer, lower segment. Photograph of Fig. 4 was made from approximately point "A."

stream courses.[5] Wetter periods, if this line of reasoning is followed, are held to be episodes of aggradation in desert streams, and, presumably, periods of the addition of debris to alluvial fans.

In short, a climatic change of some sort could be invoked to explain the deep dissection of the fans in this part of Death Valley. And, in all probability, there has been a climatic change of some significance in this region in post-Pleistocene time.

Other possible ways in which entrenchment of the fans could have been brought about involve a decrease in the caliber of the load or a reduction of the total load carried by the ephemeral streams. Such changes could be engendered by differences in bedrock resistance encountered by the downcutting torrents or by a gradual reduction in load as the headwater areas of the drainage basins were slowly worn down with the passage of time.[6] In both cases, an increased cutting ability in the lower stream courses would have been promoted, and a trenching of the fans could have followed.

But in the case of the Death Valley fan in question, none of these explanations seems necessary to account for its contemporary condition. All of the evidence points strongly to faulting as the direct cause of a rejuvenation of its intermittent stream, a rejuvenation that has led to a deep dissection of the fan and the construction of a more gentle slope below the older surface. The mountain block has recently moved up with respect to the valley block; the ephemeral stream, thus reinvigorated, has proceeded to cut a deep and narrow cleft in its lower course, and has effectively dissected the original cone and spread the material removed in the form of a newer, lower fan with more gentle inclination.

Evidence that such faulting has occurred is revealed by the presence of part of the essentially unaltered fault face along the base of the mountain block at the head of the entrenched part of the fan (Fig. 6). At this point the contact between bedrock and alluvium is along the striated and slickensided fault surface, which in its exposed portions has an invariable valleyward inclination of forty-five and one-half degrees. This surface is concealed in most places by the overlapping alluvium of the fan, but along both sides of the bedrock stream-cut small areas of the surface have been exposed and remain essentially in their pristine state (Fig. 6*b*).

Well-preserved striations on the least weathered surfaces of the fault plane indicate that movement was approximately perpendicular to the north–south strike of the fault. The shape of the long profile of the intermittent stream implies that faulting was normal; the hanging wall—or alluvial fan side—has gone down relative to the mountain block. The morphologic effects on the fan and the bedrock mountain face in the immediate vicinity of the fault have been remarkable.

The postulated sequence of events and changing series of land forms produced are indicated diagrammatically in Figure 7. It is assumed that against an initially steep mountain front an alluvial fan was built by an ever-growing ephemeral stream (Fig. 7*a*). The inclination of this fan was high—twelve

[5] Kirk Bryan, "Pre-Columbian Agriculture in the Southwest as Conditioned by Periods of Alluviation," *Annals*, Association of American Geographers, Vol. 31 (1941), pp. 227–35; Ernst Antevs, "Arroyo Cutting and Filling," *Journal of Geology*, Vol. 60(1952), pp. 377–80.

[6] A. K. Lobeck, *Geomorphology* (New York: McGraw-Hill, 1939), p. 243.

FIG. 6*a*. Part of fault face at head of entrenched channel on dissected fan. Note the pothole in the stream bed on the right side of the photograph.

FIG. 6*b*. View looking up along fault plane from head of entrenched channel. The man is standing just above the pothole shown in Fig. 6*a*. The narrowness of the lower canyon of the intermittent stream is particularly apparent in this view.

and one-half degrees on the average—and its radial extent was quite limited, perhaps to no more than half a mile. In time, the profiles of the downcutting stream and the top of the upbuilding fan met in a smooth curve at the mountain front, and the stage was set for the next major event in the developmental history.

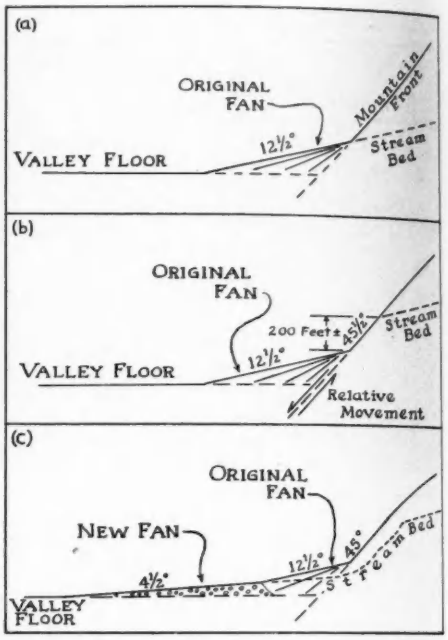

FIG. 7. Cross-sectional sketches of postulated development of dissected fan: (a) "Initial" conditions; (b) Immediately after faulting; (c) Present situation.

This occurred when a relative uplift of the mountain block took place. As a result of this movement the lower part of the stream course in bedrock and the apex of the alluvial fan were separated by a vertical distance of approximately two hundred feet (Fig. 7*b*). The lower end of the stream course in bedrock stood well above the apex of the fan, and was connected with it by the steep slope of the fault surface itself. Intermittent flow, provided mainly by occasional summer thunderstorms, thus acquired a much greater erosive power in the lower part of the canyon and on the fan, and two morphologic effects became apparent: (1) the steepened lower section of the stream bed was worn down and back into the bedrock of the mountain block; and (2) the plunging runoff from the catchment basin in the highlands was able in time to tear away a large part of the center of the initial fan and to redistribute this material below the older surface in a broader, fan-shaped deposit of lesser inclination. A deep cut in the apex of

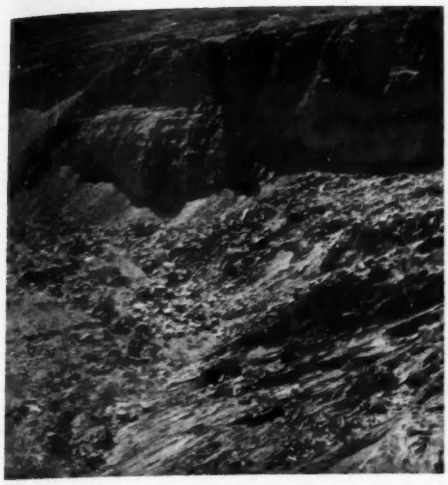

FIG. 8. View looking down along fault face toward head of entrenched channel. The internal structure of the original fan is revealed in the side of the stream cut, which at this point is nearly one hundred feet deep. A large number of limestone blocks litters the floor of the channel.

the original fan was thus made, revealing clearly its internal structure (Fig. 8).

At present the physiographic conditions of the fan and the lowest sector of the stream course are distinctive (Fig. 7*c*). Remnants of the older fan stand high and dry seventy-five to one hundred feet above the floor of the deeply entrenched channel. The profile of the canyon floor in its lowest few hundred feet reveals that the rejuvenated stream has cut back and increased the inclination of its bed in the solid bedrock of the mountain block since faulting occurred. The gradient of the last quarter-mile of the bedrock valley floor is exceedingly steep and the stream bed is pocked by a series of potholes (Fig. 6*a*), an indication that active deepening is still the dominant process there. The material excavated from the center of the old fan, along with additional debris brought down from the upper drainage basin, has been spread below and around the perimeter of the older deposit in the form of a younger fan, the surface of which has an average inclination of four and one-half degrees. As is shown in Figure 7*c*, remnants of the original fan have a steepness of about twelve and one-half degrees.

A secondary effect of faulting has been the dumping of an immense number of boulders onto the fan surface and into the incised channel from the newly exposed bedrock surface above the top of the alluvial deposit (Figs. 4 and 8). The average inclination of this part of the mountain front, as measured from a distance, remains about forty-five degrees, but the surface itself is badly pitted as a result of the removal of large blocks by weathering and the pull of gravity (Fig. 4). The rocks thus released have bounded down upon the fan, where they lie on top of the older deposits. As revealed by the section shown in Figure 8, the older part of the fan is made up of a heterogeneous collection of debris of all sizes, including many large boulders. However, a great majority of the larger blocks resting on the fan surface and on the floor of the incised channel have come from the bare slope above the fan, a fact made evident by the lithologic character of the boulders and the bedrock surface.

Thus, the topographic effects of faulting can be observed directly at this site in the dissection of the older fan, in the construction of a newer, more gentle segment around its periphery, in the steepness of the profile of the lower floor of the ephemeral stream, and in the newly created bedrock facet of the mountain front immediately above the fan.

CONCLUSIONS

Actual exposures of fault surfaces in bedrock have been reported from other parts of the American Great Basin[7] and have been seen in many other regions of the earth. Most studies of such fault exposures have stressed primarily the fact of faulting, as revealed by the fault plane itself, and the probable or possible mechanics of movement. In many areas the immediate physiographic effects of faulting have long ago been destroyed by weathering and gradation. In others the existence of a high-standing segment of the earth's crust is taken by itself to be the most important contemporary aspect of the landscape. In such

[7] F. J. Pack, "New Discoveries Relating to the Wasatch Fault," *American Journal of Science*, 5th Series, Vol. 11(1926), pp. 399–410; James Gilluly, "Basin Range Faulting along the Oquirrh Range, Utah," *Bulletin*, Geological Society of America, Vol. 39(1928), pp. 1103–30; A. J. Eardley, "Geology of the North-Central Wasatch Mountains," *Bulletin*, Geological Society of America, Vol. 55(1944), pp. 819–94; A. J. Eardley, *op. cit.* (1951), pp. 478–79.

cases a tacit assumption that faulting has had something to do with land form evolution is usually made, with or without supporting physiographic or geologic evidence.[8]

In the north arm of Death Valley, proved faulting is of interest for a number of reasons. In and by itself, the fault discussed in this study provides an instructive example of movements by segments of the earth's crust. The direct topographic effects of the fault are readily recognizable, as is its contribution to the upbuilding of the Grapevine Mountains. The phenomena of dynamic metamorphism and associated mineralization can profitably be examined at this site. And, finally, light is cast upon a recurrent problem in the Death Valley region: the explanation of dissected alluvial surfaces.

Virtually all surfaces of unconsolidated debris in this part of the southwestern Great Basin are incised by water-cut channels. Few appear at present to be undergoing an addition of new material from the adjacent highland blocks, except possibly by slumping and direct gravity fall from range-front facets. The general state of dissection is so widespread in this region that it would seem necessary to assume that an equally widespread cause—probably of climatic origin—has been responsible for most of the observed entrenchment. Yet at least *some* of the dissection has been the immediate result of a cause other than climatic. The fans along the west side of the Grapevine Mountains described and pictured above have become deeply incised primarily because their ephemeral streams have been rejuvenated by an upward lurch of the adjacent mountain range. Climatic factors may have played a minor role in the development of the present topography, but they may well assume an overpowering dominance in the future. In any case, the immediate and short-time morphologic effects of recent faulting are there for all to see. Faulting, in this case at least, has been rapid and recent enough to have produced observable and measurable effects in the landscape of the present.

[8] Excellent discussions appear in C. A. Cotton, *Landscape as Developed by the Processes of Normal Erosion* (New York: John Wiley, 2nd ed., 1948), pp. 364–444; and William D. Thornbury, *Principles of Geomorphology* (New York: John Wiley, 1954), pp. 243–75.